THE

# AMERICAN GAS-LIGHT JOURNAL.

THE OFFICIAL GAZETTE OF

## LIGHT, HEAT, WATER-SUPPLY, AND SEWERAGE.

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### CEMENT SEWER-PIPE AND WROUGHT-IRON WATER-PIPE.

The same system of investigation and improvement which we have from time to time advocated in our columns, and which is characteristic of the age in which we live, has already accomplished very beneficial results in the department of sewerage which directly pertains to any adequate water supply, and any proper regard for public health.

This range of improvement, strongly developed of late years in Europe, and which is beginning to attract proper attention in this country, consists in the substitution of pipe sewers for all intermediate and subdivided districts, in place of the disproportioned, expensive, and inefficient brick and stone sewers, too often rudely made, which have been commonly adopted.

The application thus made, of plain laws of action, has confirmed very fully, proper inference of operation; in practice, it being abundantly proved that sewers are generally made too large to keep themselves in good order, and too rudely to maintain a proper flow; beside this, their cost has been excessive. Engineers of experience and judgment are therefore revising their former practice. The chief engineer of the Croton Board emphatically condemns the system so long in vogue in New York, and the experience in Brooklyn, where the proper plan was adopted at the outset, is conclusive on this general theory.

Since the adoption of this general plan for Brooklyn very extensive use has been made of sewer-pipes made of hydraulic cement mortar, which are formed under pressure, on polished moulds, and furnish duplicated pipes not only perfect in form, but of a material which grows harder and stronger with every year of use, from the well-known property of hydraulic cement mortar when properly mixed—a process perfectly simple in itself, but very imperfectly carried out, as a general rule.

During the few years that pipes of this kind have been manufactured by the establishment mentioned below, and which is specially guarded as to the use of thoroughly prepared mortar, in distinction from pipes not thus properly made, many miles have b .. laid in Brooklyn, almost of late, to the exclusion of other kinds, and it has also been introduced in New York, at the Central Park, Jersey City, Newark, Albany, Hartford, and other prominent localities.

Wrought-iron water-pipes, lined and coated with hydraulic cement mortar, are also made by this establishment, which are great improvements on other substitutes for cast-iron pipes, now rapidly superseding the former exclusive use of iron, under conditions of expense, oxidation, tuberculation, and leakage, which involve serious objections in water-works practice. These pipes have spigot joints, can be back-filled as soon as laid, and tapped in the same manner as cast-iron pipes. Cement lined and coated water-pipes are now in use in a large number of our northern cities and villages, and have proved very satisfactory in operation.

The card of Messrs. Knight, Woodward & Crawford will be found among our advertisements.

### PETROLEUM NAPHTHA.

The petroleum naphtha is colorless, as limpid as ether, and of a density of 0.715. It has a not unpleasant ethereal odor, and vaporizes in the air, causing a notable depression of the temperature; it boils between 140 and 150° F. Concentrated sulphuric acid first causes a pale yellow coloration, which turns to dark red and finally blackish brown; at the same time the mixture evolves sufficient heat to cause it to boil. Fuming nitric acid acts violently, evolving heat, and the naphtha becomes colored, separates as a green stratum floating on top of the acid, and forms yellowish drops on the surface and at the bottom, of which the former have the odor of bitter almonds, and consist of nitro-benzole. The action of nitric acid in this experiment must be limited by immersing the flask in cold water. Dilute nitric acid, hydrochloric and nitro-muriatic acids, and alkalies, produce no perceptible change. Iodine dissolves with a red color, while bromine is at once decolorized with a kind of explosion, and after 24 hours separates a dirty colored substance. In this reaction a gas is disengaged which burns with a beautiful green color. Chlorine is absorbed with evolution of heat, likewise with formation of a gas which burns with a green-edged flame. Nitric oxyd gas passed into the naphtha gives it a fine green color; when lighted, the flame of the gas has a broad green coat and a purple centre. Hydrogen gas passed over the surface of benzine contained in a nitrogen bulb-tube, burns with a flame emitting considerable light. The petrol-benzine cannot be mixed with water, nor with wood naphtha, but readily and to any extent with absolute alcohol, oil of turpentine, bisulphid of carbon, and old petroleum. In common ether it produces a turbidity caused probably by a small percentage of water, from the same reason it is only partly taken up by alcohol. Sulphur, as well as phosphorous, dissolves only in small quantities; the latter is precipitated in white flakes from its solution in bisulphide of carbon by the addition of petrol benzine. Essential as well as fatty oils are readily soluble in it; train-oil, cocoa-nut oil, tallow, stearic and palmitic acid, palm-oil, spermaceti, wax, and paraffin do not dissolve quite readily in the cold, but rapidly and completely on applying heat. The naphtha softens virgin caoutchouc, which swells up and finally dissolves as in bisulphide of carbon. Asphaltum and Venice turpentine dissolve readily, especially with the aid of heat, and more than rosin, mastich, gum dammar, or pitch. It possesses very little or no solubility for amber, copal, seedlac, and shellac.

According to Pelouze and Cahours (*Comptes rendus, tôme* liv., p. 1241. *Annalen der Chemie u. Pharm.*, Bd. 124. Dec., 1862, p. 289), that part of the petroleum which boils at 154° Fahr., and which constitutes the greater portion of it, is the *hydride of caproylen* (*of caprol* according to Liebig), a homologue of marsh-gas; its composition is $C_{12}H_{14}$.—*Am. Druggists' Circular.*

### GAS IN RAILWAY CARS.

John Bull, who is behind brother Jonathan in many useful little inventions, desires to have his railway cars lighted with gas, but don't exactly see how it can be done. In this emergency, he talks of offering a premium for the best means of accomplishing the object. Let this hint put some of our American inventors on the right track for introducing their modes of using gas both in railway cars and steamboats. The *Journal of Gas Lighting* thus speaks of the subject:

"The methods hitherto adopted have not been found satisfactory, and Mr. Bower, who took a prominent part in the discussion (at a meeting of the Society of Arts), is engaged in making experiments on the Great Northern Railway, for the purpose of overcoming the difficulties that prevented the general application of gas-lighting to railway carriages. In a letter from that gentlemen, inserted in the *Journal of the Society of Arts*, he states the conditions required to be fulfilled; which are, that the apparatus shall occupy little room; that the application be readily made to existing railway carriages, and at little cost; that the light be better than at present at a less cost than oil; that the apparatus be simple and applicable to each carriage, independently of the others; and that the light shall be certain in its action under all circumstances, and defects be as readily corrected as in the present mode of lighting. The plan adopted on the Metropolitan Railway is only applicable to such an exceptional line; for at longer distances, the quantity of gas required for each journey, if in an uncompressed state, would occupy much more space than could be practically allowed. In some of the longer lines, in which the carriages are lighted with gas, it is stored in one or two reservoirs, from which all the lights in the train are supplied; but one of the inconveniences of that arrangement is, that if, from accident or other cause, a train becomes separated, some of the carriages are left in darkness. It appeared to be considered, by all who joined in the discussion, that an independent source of supply for each carriage is a *sina qua non*; and that compressed gas of a high illuminating power should be employed. It may be inferred from Mr. Bower's observations, that the principle object of his experiments is to devise the means of regulating the pressure of the gas from five atmospheres to a constant pressure equal to a column of water of five-tenths of an inch at the burner. He calculated that one foot and a half of petroleum or Boghead-gas, compressed twenty atmospheres, would be sufficient to supply three lights for six or seven hours, which would light an express train from London to Holyhead. In the course of the discussion, it was stated by Col. Schaffner, the American telegraphist, that he had seen railway carriages lighted with gas as far back as 1849, on the Jersey and New Georgia lines; and he proposed that the Society should send across the Atlantic, to learn how the difficulty we, in England, experience in accomplishing the object, is to be overcome; but the proposition did not meet with much favor. The means adopted for regulating the pressure of compressed gas by the portable gas companies on the continent, are not applicable to locomotive reservoirs; and though many plans have been tried, none of them comply with all the requirements of railway companies."

Notwithstanding the fact that the Continental compressed gas companies cannot regulate the burning pressure of their gas satisfactorily, it is done in this country w'th great ease. Compressed gas is used on many of our railways with perfect success, and although the reservoir, which is under the floor of the cars, contains gas at a pressure of several hundred pounds to the square inch, so perfectly is the pressure regulated by suitable apparatus, that a flame of beautiful regularity and illuminating power is the result. The Society had better take the advice of Col. Shaffner, and send over to this country for advice on the subject.

PATRIOTISM OF GAS-WORKMEN.—The fortifications around Philadelphia were commenced a few days ago, and that city will soon be surrounded by a chain of earthworks which will defy rebel armies. A large detachment of men from the Philadelphia Gas-Works were among the first to offer their services and to assist with their sturdy arms in the construction of Fort Dana, in the 21st Ward. Prof. John C. Cresson, the engineer of the works, delivered a speech on the occasion, which will be remembered as one of the events connected with the great contests we are now engaged in. Fortunately, the rebels have been compelled to make double quick time in their retreat to Dixie—if they ever get there—and the fort may never require to be used.

ELECTRIC LIGHT IN PARIS.—The lighting of Paris, it is stated, is to be intrusted to M. J. Van Malderan, who has invented a new electric light, one jet of which is equal to 2,200 jets of gas. The Place Saint Sulpice is destined to be the first where the essay is to be tried.

# GAS-LIGHT COMPANIES IN THE UNITED STATES.

*Compiled from official sources expressly for the* AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

| No. | Chartered. | Town. | State. | Chartered Capital. | Par Val. Per Sh. $ | Semi-Ann'l Div'd. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1857 | Adrian | Mich. | 50,000 | 50 | — | May & November. | 4,000 | 3 50 | .... | .... | |
| 2 | 1856 | Akron | O. | 20,000 | 33⅓ | — | Do. | 3,500 | 3 00 | .... | .... | |
| 3 | 1845 | Albany | N. Y. | 250,000 | 20 | 4 | January & July. | 65,000 | 3 00 | 120 | .... | None in market. |
| 4 | 1858 | Albion | N. Y. | 30,000 | 100 | — | Do. | 3,000 | 3 80 | .... | .... | |
| 5 | 1851 | Alexandria | Va. | 166,580 | — | — | City Works. | 9,000 | 3 50 | .... | .... | |
| 6 | 1852 | Alleghany | Pa. | 200,000 | 25 | 4 | May & November. | 25,000 | 3 00 | .... | .... | |
| 7 | 1853 | Allentown | Pa. | 60,000 | 100 | 3½ | Do. | 5,000 | 3 50 | .... | .... | |
| 8 | 1857 | Alton | Ill. | 75,000 | — | — | Private Works. | 4,000 | 3 50 | .... | .... | |
| 9 | 1859 | Altoona | Pa. | 40,000 | 20 | 4 | January & July. | 5,000 | 3 00 | .... | .... | |
| 10 | 1859 | Amesbury and Salisbury | Mass. | 30,000 | 25 | — | Do. | 7,000 | 4 00 | .... | .... | |
| 11 | 1858 | Annapolis | Md. | 100,000 | 25 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 12 | 1858 | Ann Arbor | Mich. | 23,000 | 50 | 5 | March & September. | 5,500 | 4 00 | .... | .... | |
| 13 | 1858 | Astoria | N. Y. | 20,000 | 50 | — | Do. | 6,000 | 4 00 | .... | .... | |
| 14 | 1855 | Atlanta | Ga. | 50,000 | 25 | 5 | January & July. | 12,000 | 5 00 | .... | .... | |
| 15 | 1857 | Attleboro' | Mass. | 6,000 | 50 | 3 | Do. | 2,000 | 6 00 | .... | .... | |
| 16 | 1850 | Auburn | N. Y. | 80,000 | 50 | 5 | Do. | 10,000 | 7 00 | .... | .... | |
| 17 | 1851 | Augusta | Ga. | 80,000 | 25 | 8 | Do. | 9,000 | 6 00 | .... | .... | |
| 18 | 1853 | Augusta and Hallowell | Me. | 84,700 | 50 | 5 | Do. | 10,000 | 4 00 | .... | .... | |
| 19 | 1860 | Aurora | Ind. | 10,000 | — | — | Private Works. | 3,500 | 3 50 | .... | .... | Formerly used Sanders' Water-Gas. Recently altered to Coal Gas-Works. |
| 20 | 1817 | Baltimore | Md. | 550,000 | 100 | 5 | June & December. | 150,000 | 2 50 | 150 | .... | None in market. |
| 1 | 1852 | Bangor | Me. | 120,000 | 100 | 4 | January & July. | 12,000 | 3 50 | .... | .... | |
| 2 | 1855 | Batavia | N. Y. | 32,000 | 20 | 4 | Do. | 2,500 | 4 00 | .... | .... | |
| 3 | 1853 | Bath | Me. | 65,000 | 100 | 3 | April & October. | 10,000 | 3 75 | .... | .... | |
| 4 | 1859 | Bath | N. Y. | 15,000 | 50 | — | May & November. | 3,000 | 7 00 | .... | .... | |
| 5 | 1861 | Battle Creek | Mich. | 15,000 | — | — | January & July. | | | .... | .... | |
| 6 | 1858 | Belfast | Me. | 14,000 | 100 | — | Do. | 7,000 | 7 00 | .... | .... | |
| 7 | 1856 | Bellefont | Pa. | 20,000 | 25 | 2 | Do. | 3,500 | 4 00 | .... | .... | |
| 8 | | Beloit | Wis. | 30,000 | — | — | Do. | 4,000 | 4 00 | .... | .... | |
| 9 | 1854 | Bethlehem | Pa. | 50,000 | 50 | 4 | June & December. | 2,000 | 3 20 | .... | .... | |
| 30 | 1859 | Beverly | Mass. | 40,000 | 100 | — | January & July. | 4,000 | 4 00 | .... | .... | |
| 1 | 1853 | Binghampton | N. Y. | 50,000 | 50 | 3½ | Do. | 10,000 | 4 00 | .... | .... | |
| 2 | 1859 | Birmingham | Pa. | 40,000 | 50 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 3 | 1855 | Bloomington | Ill. | 40,000 | 50 | — | Do. | 6,000 | 4 00 | .... | .... | |
| 4 | 1853 | Bordentown | N. J. | 50,000 | 25 | 3 | June & December. | 4,000 | 3 80 | .... | .... | |
| 5 | 1822 | Boston | Mass. | 1,000,000 | 500 | 5 | Do. | 130,000 | 2 25 | .... | .... | |
| 6 | 1859 | Brattleboro' | Vt. | 21,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 7 | 1851 | Bridgeport | Ct. | 90,000 | 25 | 4 | January & July. | 10,000 | 4 00 | 90 | .... | Passed last dividend. |
| 8 | 1857 | Bridgeton | N. J. | 50,000 | 20 | — | Do. | 5,000 | 4 00 | .... | .... | |
| 9 | 1856 | Bristol | Pa. | 30,000 | 25 | 3 | February & August. | 3,000 | 4 00 | .... | .... | |
| 40 | 1855 | Bristol | R. I. | 35,000 | 50 | 2 | January & July. | 6,000 | 4 00 | .... | .... | |
| 1 | 1859 | Brockport | N. Y. | 25,000 | 100 | 3 | Do. | 1,500 | 4 00 | .... | .... | |
| 2 | 1853 | Brookline | Mass. | 66,000 | 100 | 4 | February & August. | 3,500 | 4 00 | .... | .... | |
| 3 | 1825 | Brooklyn | N. Y. | 2,000,000 | 25 | 5 | January & July. | 75,000 | 2 50 | 170 | 160 | |
| 4 | | Brownsville | Pa. | | | | Do. | | | .... | .... | |
| 5 | 1848 | Buffalo | N. Y. | 600,000 | 50 | 5 | Do. | 70,000 | 2 90 | 140 | 125 | |
| 6 | 1852 | Burlington | N. J. | 100,000 | 25 | 3½ | Do. | 5,000 | 4 00 | 105 | .... | |
| 7 | 1853 | Burlington | Vt. | 75,000 | 25 | 2½ | Do. | 10,000 | 4 50 | .... | .... | |
| 8 | 1859 | Burlington | Iowa. | 65,000 | 50 | — | Do. | 8,000 | 4 00 | .... | .... | |
| 9 | 1861 | Calais | Me. | 90,000 | 100 | — | Do. | 10,000 | 3 50 | .... | .... | |
| 50 | 1852 | Cambridge | Mass. | 300,000 | 100 | 5 | February & August. | 20,000 | 3 50 | 100 | 97½ | |
| 1 | 1852 | Camden | N. J. | 300,000 | 100 | 3 | April & October. | 15,000 | 3 50 | 105 | 100 | |
| 2 | 1853 | Canandaigua | N. Y. | 50,000 | 50 | — | January & July. | 3,000 | 4 00 | 90 | 80 | |
| 3 | 1856 | Canton | O. | 19,000 | 50 | 6 | March & September. | 6,000 | 3 00 | .... | .... | |
| 4 | 1853 | Cape Island | N. J. | 80,000 | 100 | — | October. | 10,000 | 6 00 | .... | .... | Watering place.—These Works only run in summer. |
| 5 | 1860 | Carbondale | Pa. | 16,000 | 25 | — | March & September. | 5,000 | 4 00 | .... | .... | |
| 6 | 1855 | Carlisle | Pa. | 30,000 | 25 | — | January & July. | 4,000 | 4 00 | .... | .... | |
| 7 | 1856 | Catasauqua | Pa. | 15,000 | 25 | 5 | May & November. | 2,000 | 4 00 | .... | .... | |
| 8 | 1858 | Catskill | N. Y. | | | — | Private Works. | 3,000 | 3 00 | .... | .... | Owned by G. T. Sutton. |
| 9 | 1857 | Chambersburg | Pa. | 30,000 | 25 | — | January & July. | 3,000 | 4 00 | .... | .... | |
| 60 | 1846 | Charleston | S. C. | 723,800 | 25 | 4 | Do. | 50,000 | 4 00 | .... | .... | |
| 1 | 1851 | Charlestown | Mass. | 200,000 | 50 | 4 | Do. | 30,000 | 3 00 | 105 | .... | |
| 2 | 1858 | Charlotte | N. C. | 14,000 | 50 | 10 | March & September. | 3,500 | 6 00 | .... | .... | |
| 3 | 1859 | Charlotteville | Vt. | 15,000 | 25 | — | Do. | 4,000 | 4 50 | .... | .... | |
| 4 | 1851 | Chelsea | Mass. | 100,000 | 100 | 3½ | January & July. | 8,000 | 3 50 | .... | .... | |
| 5 | 1856 | Chester | Pa. | 35,000 | 25 | 3 | April & October. | 4,000 | 4 00 | .... | .... | |
| 6 | 1849 | Chicago | Ill. | 1,300,000 | 25 | 5 | January & July. | 100,000 | 2 50 | 150 | 140 | Very scarce. Stock wanted. |
| 7 | 1857 | Chicopee | Mass. | 50,000 | 20 | — | Do. | | 4 00 | .... | .... | |
| 8 | 1851 | Chillicothe | O. | 40,000 | 25 | 4 | Do. | 12,000 | 3 50 | .... | .... | |
| 9 | 1841 | Cincinnati | O. | 1,600,000 | 100 | 5 | Do. | 225,000 | 2 50 | .... | .... | |
| 70 | 1859 | Citizens', Brooklyn | N. Y. | 1,000,000 | 20 | — | Do. | 135,000 | 2 00 | 128 | 125 | |
| 1 | | Clarkesville | Tenn. | 100,000 | 50 | — | Do. | 5,000 | 4 00 | .... | .... | |
| 2 | 1860 | Claremont | N. H. | 20,000 | 100 | — | March & September. | 3,000 | 4 00 | .... | .... | |
| 3 | 1846 | Cleveland | O. | 200,000 | 10 | 5 | January & July. | 20,000 | 3 00 | .... | .... | |
| 4 | 1858 | Clinton | Mass. | 30,000 | 500 | 5 | Do. | 3,000 | 4 00 | .... | .... | |
| 5 | 1859 | Clyde | N. Y. | 10,000 | 50 | 4 | Do. | 2,500 | 4 00 | .... | .... | |
| 6 | 1854 | Cohoes | N. Y. | 50,000 | 20 | 3½ | April & October. | 5,000 | 3 60 | .... | .... | |
| 7 | 1860 | Cold Spring | N. Y. | 30,000 | 50 | — | Do. | 3,500 | 4 00 | 80 | .... | Formerly Rosin-Gas, but now Coal. A well managed company. Stock firmly held. |
| 8 | 1860 | Cold Water | Mich. | 25,000 | 50 | 5 | January & July. | 4,000 | 4 60 | .... | .... | |
| 9 | 1852 | Columbia | Pa. | 37,500 | 25 | — | Do. | 4,000 | 3 50 | .... | .... | |
| 80 | 1852 | Columbia | S. C. | 44,000 | 25 | 4 | Do. | 6,000 | 6 00 | .... | .... | |
| 1 | 1857 | Columbia | Cal. | 50,000 | 25 | — | Do. | 4,500 | 10 00 | .... | .... | |
| 2 | 1853 | Columbus | Ga. | 54,000 | 25 | 5 | Do. | 5,000 | 7 00 | .... | .... | |
| 3 | 1850 | Columbus | O. | 100,000 | 10 | 6 | Do. | 30,000 | 3 00 | .... | .... | |
| 4 | 1853 | Concond | N. H. | 50,000 | 50 | 5 | Do. | 8,000 | 3 50 | .... | .... | |
| 5 | 1853 | Covington and Newport | Ky. | 100,000 | 50 | 3½ | Do. | 28,000 | 4 00 | .... | .... | |
| 6 | 1854 | Cumberland | Md. | 60,000 | 50 | 3 | Do. | 6,000 | 4 00 | .... | .... | |
| 7 | 1857 | Danbury | Ct. | 50,000 | 25 | 4 | Do. | 2,000 | 3 75 | .... | .... | |
| 8 | 1856 | Danville | Pa. | 30,000 | 25 | — | June & December. | 3,000 | 4 00 | .... | .... | |
| 9 | 1855 | Davenport | Iowa. | 56,000 | 100 | — | Do. | 6,000 | 5 00 | .... | .... | |
| 90 | 1848 | Dayton | O. | 50,000 | 25 | 5 | February & August. | 8,000 | 3 50 | .... | .... | |
| 1 | 1853 | Dedham | Mass. | 40,000 | 50 | — | January & July. | 3,000 | 4 00 | .... | .... | |
| 2 | 1860 | Delaware | O. | 30,000 | 25 | — | Do. | 2,500 | 3 00 | .... | .... | |
| 3 | 1849 | Detroit | Mich. | 500,000 | 50 | 5 | Do. | 30,000 | 3 50 | 160 | 150 | Excellent Stock. No sales. |
| 4 | 1860 | Dobbs' Ferry | N. Y. | 25,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 5 | 1854 | Dorchester | Mass. | 150,000 | 100 | — | Do. | 14,000 | 4 00 | .... | .... | |
| 6 | 1859 | Dover | Del. | 12,000 | — | — | Private Works. | 2,000 | 4 00 | .... | .... | |
| 7 | | Dover | N. H. | | | | January & July. | | | .... | .... | |
| 8 | 1857 | Doylestown | Pa. | 50,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 9 | 1854 | Dubuque | Iowa. | 100,000 | 50 | — | Do. | 17,000 | 4 50 | .... | .... | |
| 100 | 1853 | East Boston | Mass. | 133,000 | 25 | 4 | Do. | 20,000 | 3 50 | .... | 145 | No transactions. |
| 1 | 1858 | East Greenwich | R. I. | 11,200 | 100 | 15 | Do. | 3,000 | 7 00 | .... | .... | |
| 2 | 1861 | East Hampton | Mass. | 10,000 | 25 | — | Do. | 5,000 | 9 00 | .... | .... | |
| 3 | 1861 | East New York | N. Y. | 50,000 | 50 | — | Do. | 12,000 | 3 50 | .... | .... | |
| 4 | 1857 | Easton | Md. | 9,000 | 10 | — | Do. | 1,500 | 7 00 | .... | .... | |
| 5 | 1850 | Easton | Pa. | 125,000 | 50 | 4 | June & December. | 6,000 | 3 60 | .... | .... | |
| 6 | 1856 | Eastport | Me. | 50,000 | 55 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 7 | 1855 | Elizabeth | N. J. | 100,000 | 20 | 4 | January & July. | 14,000 | 3 50 | .... | .... | |
| 8 | | Ellicott's Mills | Md. | 10,000 | — | — | Do. | 4,000 | 4 00 | .... | .... | |
| 9 | 1852 | Elmira | N. Y. | 50,000 | 25 | 3½ | Do. | 5,000 | 4 00 | .... | .... | |
| 110 | 1852 | Erie | Pa. | 68,000 | 50 | 3½ | June & December. | 10,000 | 3 00 | .... | .... | |
| 11 | 1853 | Evansville | Ind. | 60,000 | 50 | 4 | January & July. | 12,000 | 4 00 | 110 | .... | A very good Company. |
| 12 | | Exeter | N. H. | 60,000 | — | — | Do. | 12,000 | | .... | .... | |
| 13 | | Fair Haven | Ct. | 20,000 | 25 | | Do. | 8,000 | 4 00 | .... | .... | |
| 14 | 1847 | Fall River | Mass. | 26,000 | — | — | Private Works. | 12,000 | 3 50 | .... | .... | |
| 15 | 1859 | Fayetteville | N. C. | 25,000 | 100 | 6 | January & July. | 7,000 | 6 00 | .... | .... | |
| 16 | | Fifth Ward (Milwaukee) | Wis. | 50,000 | 25 | — | Do. | 10,000 | 4 00 | .... | .... | |
| 17 | 1857 | Fishkill | N. Y. | 10,000 | 20 | — | April & October. | 1,500 | 9 00 | .... | .... | Make Petroleum-Gas. |
| 18 | 1853 | Fitchburg | Mass. | 100,000 | 50 | 3 | January & July. | 5,000 | 4 00 | .... | .... | |
| 19 | 1859 | Flemington | N. J. | 20,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 120 | 1855 | Flushing | N. Y. | 40,000 | 50 | 1½ | March & September. | 6,500 | 4 00 | .... | .... | |
| 21 | 1858 | Fort Wayne | Ind. | 50,000 | 25 | — | Do. | 6,000 | 4 00 | .... | .... | |
| 22 | 1851 | Frankfort | Ky. | 30,000 | — | — | City Works. | 5,500 | 4 50 | .... | .... | |
| 23 | 1851 | Frederick City | Md. | 36,000 | 100 | — | January & July. | 5,000 | 6 70 | .... | .... | |
| 24 | 1854 | Fredericksburg | Va. | 72,500 | 50 | 5 | Do. | 4,500 | 4 00 | .... | .... | |
| 25 | 1858 | Fredonia (Natural Gas) | N. Y. | 10,000 | 100 | — | Do. | 2,000 | 4 00 | .... | .... | Unlimited supply of Natural Gas. |
| 26 | 1856 | Freeport | Ill. | 20,000 | 100 | — | May & November. | 10,000 | 4 00 | .... | .... | |

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| No. | Chartered | Town. | State. | Chartered Capital. | Par Val. Per Sh. $ | Semi-Ann'l Div'd. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127 | 1859 | Fremont | O. | 25,000 | 25 | — | May & November. | 2,000 | 4 50 | .... | .... | |
| 28 | 1858 | Fulton | N. Y. | 12,000 | 100 | — | Do. | 4,000 | 7 00 | .... | .... | |
| | | | | | | | | | | .... | .... | |
| 29 | 1855 | Galena | Ill. | 70,000 | 100 | — | Do. | 8,000 | 4 00 | .... | .... | |
| 130 | 1859 | Galion | O. | 25,000 | 25 | — | January & July. | 1,800 | 3 00 | .... | .... | |
| 31 | 1858 | Galveston | Texas. | 150,000 | 50 | — | May & November. | 7,000 | 6 00 | .... | .... | |
| 32 | 1854 | Gardiner | Me. | 100,000 | 50 | 4 | Do. | 8,000 | 4 00 | .... | .... | |
| 33 | 1853 | Geneva | N. Y. | 75,000 | 25 | 2½ | Do. | 6,000 | 4 00 | .... | .... | |
| 34 | 1851 | Germantown | Pa. | Merged | into | the | Philadelphia Works. | 12,000 | 2 25 | .... | .... | |
| 35 | 1859 | Gettysburg | Pa. | 20,000 | 50 | 3 | January & July. | 2,500 | 4 00 | .... | .... | |
| 36 | 1854 | Glenn's Falls | N. Y. | 35,000 | 50 | 3 | February & August. | 4,000 | 4 00 | .... | .... | |
| 37 | 1854 | Gloucester | Mass. | 40,000 | 50 | — | January & July. | 5,000 | 3 50 | .... | .... | |
| 38 | 1857 | Gloversville | N. Y. | 15,000 | 25 | — | Do. | 3,000 | 3 50 | .... | .... | |
| 39 | 1858 | Grand Rapids | Mich. | 50,000 | 20 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 140 | 1855 | Great Barrington | Mass. | 5,000 | 100 | 5 | April & October. | 2,000 | 7 00 | .... | .... | |
| 41 | 1849 | Great Falls | N. H. | 50,000 | 100 | 3 | Do. | 3,000 | 4 00 | .... | .... | |
| 42 | 1860 | Greenfield | Mass. | 20,000 | 50 | 2 | January & July. | 2,500 | 4 00 | .... | .... | Close corporation. |
| 43 | 1853 | Greenpoint | N. Y. | 100,000 | 50 | 5 | Do. | 20,000 | 3 00 | .... | .... | |
| 44 | 1859 | Greensboro' | N. C. | 12,000 | 50 | — | April & October. | 3,000 | 7 00 | .... | .... | |
| 45 | 1858 | Greensburg | Pa. | 30,000 | 25 | 3 | May & November. | 2,000 | 3 00 | .... | .... | |
| 46 | 1854 | Hagerstown | Md. | 15,000 | 20 | — | January & July. | 2,000 | 6 00 | .... | .... | |
| 47 | | Hamilton | O. | 15,000 | | | Do. | | | .... | .... | |
| 48 | 1859 | Hannibal | Mo. | 100,000 | 100 | — | Do. | 6,000 | 3 50 | .... | .... | |
| 49 | 1857 | Harlem | N. Y. | 350,000 | 50 | 3½ | Do. | 25,000 | 3 00 | .... | 145 | |
| 150 | 1855 | Harrisburg | Pa. | 100,000 | — | 4 | Do. | 5,000 | 4 00 | .... | .... | |
| 51 | 1849 | Hartford | Ct. | 200,000 | 25 | 4 | Do. | 25,000 | 3 00 | 150 | 140 | Stock in demand. |
| 52 | | Hastings | N. Y. | | | | Do. | 8,000 | 4 00 | .... | .... | |
| 53 | 1853 | Haverhill | Mass. | 50,000 | 50 | — | Do. | 5,000 | 4 00 | .... | .... | |
| 54 | 1859 | Haverstraw | N. Y. | 20,000 | 100 | — | Do. | 5,000 | 4 00 | .... | .... | |
| 55 | 1861 | Hayesville | Mass. | 15,000 | 25 | | Do. | 4,000 | 4 00 | .... | .... | |
| 56 | 1859 | Hempstead | N. Y. | 16,000 | 25 | — | Do. | 1,000 | 4 00 | .... | .... | |
| 57 | 1862 | Hoboken | N. J. | 100,000 | 25 | 3 | Do. | 30,000 | 2 50 | .... | 100 | Works not yet built. |
| 58 | 1856 | Hollidaysburg | Pa. | 30,000 | 25 | 2 | Do. | 4,000 | 3 50 | .... | .... | |
| 59 | 1861 | Holyoke | Mass. | 20,000 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 160 | 1861 | Homer & Cortlandt | N. Y. | 40,000 | 100 | — | Do. | 6,000 | 4 00 | .... | .... | |
| 61 | 1854 | Honesdale | Pa. | 30,000 | 25 | 3 | Do. | 2,500 | 4 00 | .... | .... | |
| 62 | 1860 | Hornellsville | N. Y. | 12,000 | 50 | — | Do. | 2,000 | 4 00 | .... | .... | |
| 63 | 1853 | Hudson | N. Y. | 50,000 | 100 | 3½ | February & August. | 3,000 | 4 00 | .... | .... | |
| 64 | 1857 | Huntington | Pa. | 18,000 | 50 | 3 | Do. | 2,000 | 3 50 | .... | .... | |
| 65 | 1856 | Huntsville | Ala. | 7,325 | 25 | — | June & December. | 2,000 | 5 00 | .... | .... | |
| 66 | | Indianapolis | Ind. | 150,000 | — | — | Do. | 15,000 | 5 00 | .... | .... | |
| 67 | 1857 | Iowa City | Iowa. | 40,000 | 50 | — | February & August. | 4,000 | 4 50 | .... | .... | |
| 68 | 1852 | Ithaca | N. Y. | 75,000 | 25 | 3½ | January & July. | 6,000 | 4 00 | .... | .... | |
| 69 | 1857 | Jackson | Mich. | 25,000 | 50 | 5 | Do. | 6,000 | 3 50 | .... | .... | |
| 170 | | Jackson | Miss. | 80,000 | 50 | — | Do. | 4,000 | 4 50 | .... | .... | |
| 71 | | Jackson | Cal. | 50,000 | 30 | — | Do. | 4,000 | 10 00 | .... | .... | |
| 72 | | Jacksonville | Flor. | 30,000 | 20 | — | Do. | 2,000 | 7 00 | .... | .... | |
| 73 | | Jacksonville | Ind. | 50,000 | 50 | — | Do. | 4,000 | 5 00 | .... | .... | |
| 74 | 1858 | Jacksonville | Mo. | 25,000 | 25 | — | Do. | 7,000 | 6 00 | .... | .... | |
| 75 | 1856 | Jamaica | N. Y. | 20,000 | — | 4 | Do. | 6,000 | 4 00 | .... | .... | |
| 76 | 1853 | Jamaica Plain | Mass. | 10,000 | 100 | 4 | Do. | 3,000 | 4 00 | .... | .... | |
| 77 | | Jamestown | N. Y. | 25,000 | — | — | Do. | 4,000 | 4 00 | .... | .... | |
| 78 | 1856 | Janesville | Wis. | 50,000 | 100 | — | Do. | 12,000 | 4 00 | .... | .... | |
| 79 | | Jeffersonville | Md. | 30,000 | 25 | | Do. | 4,000 | 4 00 | .... | .... | |
| 180 | 1853 | Jersey City | N. J. | 300,000 | — | 5 | Do. | 30,000 | 3 00 | 150 | .... | No sales since formation of Hoboken Co. |
| 81 | 1858 | Jersey Shore | Pa. | 15,000 | 25 | — | Do. | 2,000 | 3 70 | .... | .... | |
| 82 | 1856 | Johnstown | Pa. | 80,000 | 25 | 3 | Do. | 8,000 | 3 00 | .... | .... | |
| 83 | 1857 | Joliet | Ill. | 300,000 | 100 | — | June & December. | 6,000 | 4 00 | .... | .... | |
| 84 | 1858 | Kalamazoo | Mich. | 30,000 | 50 | 5 | Do. | 10,000 | 4 00 | .... | .... | |
| 85 | 1860 | Keene | N. H. | 60,000 | 100 | — | Do. | 4,500 | 4 00 | .... | .... | |
| 86 | 1855 | Keokuk | Iowa. | 100,000 | 100 | — | January & July. | 10,000 | 4 50 | .... | .... | |
| 87 | 1855 | Kingston | Pa. | 50,000 | 50 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 88 | 1859 | Kittanning | Pa. | 20,000 | — | — | Doubtful. | 5,000 | 4 00 | .... | .... | Said to be a fraud. |
| 89 | 1854 | Knoxville | Tenn. | 63,000 | — | — | April & October. | 4,000 | 5 00 | .... | .... | |
| 190 | 1860 | Laconia | N. H. | 20,000 | 100 | — | Do. | 4,000 | 6 00 | .... | .... | |
| 91 | 1859 | La Crosse City | Wis. | 100,000 | 50 | — | June & December. | 10,000 | 5 00 | .... | .... | |
| 92 | 1854 | Lafayette | Ind. | 60,000 | 50 | 4 | January & July. | 10,000 | 3 25 | .... | .... | |
| 93 | 1856 | Lambertville | N. J. | 30,000 | 25 | — | Do. | 2,600 | 4 00 | .... | .... | |
| 94 | 1849 | Lancaster | Pa. | 100,000 | 50 | 4 | Do. | 10,000 | 3 00 | .... | .... | |
| 95 | 1856 | Lancaster | O. | 25,000 | 100 | 5 | Do. | 5,000 | 3 50 | .... | .... | |
| 96 | 1855 | Lansinburg | N. Y. | 25,000 | 100 | — | Private Works. | 7,000 | 4 00 | .... | .... | |
| 97 | 1849 | Lawrence | Mass. | 200,000 | 100 | 4 | February & August. | 15,000 | 3 50 | .... | .... | |
| 98 | 1859 | Leavenworth | Kansas. | 200,000 | 25 | — | January & July. | 10,000 | 5 00 | .... | .... | |
| 99 | 1856 | Lebanon | Pa. | 26,000 | 50 | — | February & August. | 5,000 | 4 00 | .... | .... | |
| 200 | 1861 | Le Roy | N. Y. | 25,000 | 50 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 1 | 1858 | Lewisburg | Pa. | 20,000 | 100 | — | January & July. | 4,000 | 4 00 | .... | .... | |
| 2 | 1852 | Lewiston | Me. | 100,000 | 100 | 3 | Do | 10,000 | 3 20 | .... | .... | |
| 3 | 1856 | Lewistown | Pa, | 30,000 | 50 | 3 | April & October. | 3,000 | 3 10 | .... | .... | |
| 4 | 1853 | Lexington | Ky. | 100,000 | 25 | 4 | January & July. | 5,000 | 4 00 | .... | .... | |
| 5 | 1853 | Little Falls | N. Y. | 112,000 | 25 | — | Do. | 3,500 | 7 00 | .... | .... | |
| 6 | 1861 | Little Rock | Ark. | 20,000 | — | — | Do. | 5,000 | 6 00 | .... | .... | |
| 7 | 1858 | Lockhaven | Pa. | 28,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 8 | | Lockport | N. Y. | 100,000 | 50 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 9 | 1838 | Louisville | Ky. | 600,000 | 50 | 6 | Do. | 80,000 | 2 50 | 125 | .... | But $481,400 stock has been sold. This Company has a large contingent fund and undivided profit on hand. |
| 210 | 1849 | Lowell | Mass. | 200,000 | 25 | 5 | Do. | 50,000 | 3 25 | .... | .... | |
| 11 | 1852 | Lynchburg | Va. | 70,000 | 25 | 5 | Do. | 6,000 | 3 80 | .... | .... | |
| 12 | 1852 | Lynn | Mass. | 55,000 | 50 | 4 | Do. | 20,000 | 4 00 | .... | .... | |
| 13 | 1859 | Lyons | N. Y. | 30,000 | 100 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 14 | 1852 | Macon | Ga. | 75,160 | 25 | 6 | Do. | 5,000 | 5 00 | .... | .... | |
| 15 | 1851 | Madison | Ind. | 160,000 | 25 | 3 | Do. | 10,100 | 3 50 | .... | .... | |
| 16 | 1855 | Madison | Wis. | 100,000 | 25 | — | Do. | 5,000 | 5 00 | .... | .... | |
| 17 | 1854 | Malden & Melrose | Mass. | 50,000 | 25 | 3 | February & August. | 5,000 | 4 00 | .... | .... | |
| 18 | 1852 | Manayunk | Pa. | 40,000 | 100 | — | Do. | 7,000 | 4 00 | .... | .... | |
| 19 | 1852 | Manchester | N. H. | 100,000 | 100 | 5 | January & July. | 25,000 | 3 00 | .... | .... | |
| 220 | 1830 | Manhattan (N. Y. City) | N. Y. | 4,000,000 | 50 | 5 | Do. | 600,000 | 2 50 | 300 | 375 | |
| 21 | | Mansfield | O. | 25,000 | — | — | Do. | 10,000 | 4 00 | .... | .... | |
| 22 | 1854 | Marblehead | Mass. | 40,000 | 100 | 3 | Do. | 1,000 | 4 00 | .... | .... | |
| 23 | | Marlboro' | Mass. | 20,000 | — | — | Do. | 8,000 | 4 00 | .... | .... | |
| 24 | | Mauch Chunk | Pa. | 50,000 | 50 | — | Do. | 7,000 | 4 00 | .... | .... | |
| 25 | 1857 | Marietta | O. | 50,000 | 50 | — | Do. | 7,000 | 4 00 | .... | .... | |
| 26 | 1858 | Marysville | Cal. | 50,000 | 100 | — | Do. | 4,000 | 12 50 | .... | .... | |
| 27 | 1857 | Massilon | O. | 20,000 | 25 | — | Do. | 5,000 | 3 00 | .... | .... | |
| 28 | 1855 | Meadville | Pa. | 39,500 | 25 | — | Do. | 4,000 | 3 50 | .... | .... | |
| 29 | | Medina | N. Y. | 2,000 | 100 | — | Do. | 2,000 | 7 00 | .... | .... | |
| 230 | 1852 | Memphis | Tenn. | 800,000 | 100 | 5 | June & December. | 12,000 | 3 50 | .... | .... | |
| 31 | | Meriden | Ct. | 20,000 | | | Do. | | | .... | .... | |
| 32 | 1859 | Metropolitan (N. Y. City) | N. Y. | 1,000,000 | 100 | — | January & July. | 200,000 | 2 50 | .... | .... | |
| 33 | 1859 | Middleboro' | Mass. | 15,000 | — | — | Private Works. | | 6 00 | .... | .... | |
| 34 | 1853 | Middletown | Ct. | 50,000 | 25 | 3 | March & September. | 5,000 | 3 80 | .... | .... | |
| 35 | | Middletown | N. Y. | | 25 | — | Private Works. | 3,000 | 3 00 | .... | .... | Owned by G. T. Sutton. |
| 36 | | Milford | Mass. | 20,000 | — | — | Do. | | 4 00 | .... | .... | |
| 37 | | Milledgeville | Ga. | 100,000 | 50 | — | Do. | | 5 00 | .... | .... | |
| 38 | | Milton | Pa. | 10,000 | | | Do. | | | .... | .... | |
| 39 | 1847 | Milwaukee | Wis. | 400,000 | 50 | 5 | January & July. | 24,000 | 3 50 | 150 | .... | |
| 240 | 1852 | Mobile | Ala. | 200,000 | — | — | Do. | 30,000 | 4 50 | .... | .... | |
| 41 | 1836 | Monroe | Mich. | 40,000 | 50 | — | Do. | 5,000 | 3 50 | 50 | .... | |
| 42 | 1852 | Montgomery | Ala. | 100,000 | 25 | 4 | February & August. | 7,000 | 6 00 | .... | .... | |
| 43 | 1856 | Montpelier | Vt. | 30,000 | 25 | 3 | January & July. | 5,000 | 4 50 | .... | .... | |
| 44 | 1859 | Morrisania | N. Y. | 30,000 | 50 | — | Do. | | 4 00 | .... | .... | |
| 45 | 1859 | Morristown | N. J. | 18,000 | 50 | — | Do. | 3,500 | 4 00 | .... | .... | |
| 46 | 1854 | Mount Holly | N. J. | 16,650 | 25 | 3 | April & October. | 2,000 | 7 00 | .... | .... | |
| 47 | | Mount Vernon | O. | 50,000 | 100 | — | Do. | | 4 00 | .... | .... | |
| 48 | 1857 | Muscatine | Iowa. | 50,000 | 100 | — | January & July. | 3,000 | 4 50 | .... | .... | |
| 49 | 1854 | Nantucket | Mass. | 50,000 | 100 | 3 | February & August. | 6,000 | 4 00 | .... | .... | |

## GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

*Compiled from official sources expressly for the* AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

| No. | Chartered. | Town. | State. | Chartered Capital. | Par Val. per Sh. $ | Semi-Ann'l Div. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 | 1852 | NASHUA | N. H. | 45,000 | 50 | 3½ | January & July. | 10,000 | 3 50 | .... | .... | |
| 51 | 1850 | NASHVILLE | Tenn. | 200,000 | 50 | 5 | Do. | 25,000 | 3 50 | .... | .... | |
| 52 | 1858 | NATCHEZ | Miss. | 46,000 | 50 | — | Do. | 20,000 | 5 00 | .... | .... | |
| 53 | 1852 | NEW ALBANY | Ind. | 200,000 | 50 | 3½ | Do. | 16,000 | 3 50 | .... | .... | |
| 54 | 1846 | NEWARK | N. J. | 862,000 | 50 | 5 | Do. | 45,000 | 3 62 | 130 | .... | Always a favorite stock. |
| 55 | 1856 | NEWARK | O. | 30,000 | 100 | — | Do. | 7,000 | 5 40 | .... | .... | |
| 56 | 1852 | NEW BEDFORD | Mass. | 130,000 | 100 | 5 | Do. | 15,000 | 2 90 | 102 | .... | Well managed and kept quiet. |
| 57 | 1859 | NEWBERN | N. C. | 22,000 | 100 | 6 | Do. | 6,000 | 3 50 | .... | .... | |
| 58 | | NEW BRITAIN | Ct. | 30,000 | 20 | 5 | Do. | 3,000 | 4 00 | .... | .... | |
| 59 | 1851 | NEW BRUNSWICK | N. J. | 100,000 | 20 | 4 | Do. | 8,000 | 3 00 | 115 | .... | |
| 260 | 1852 | NEWBURG | N. Y. | 67,000 | 20 | 4 | Do. | 10,000 | 4 00 | 105 | .... | |
| 61 | 1852 | NEWBURYPORT | Mass. | 150,000 | 10 | 4 | Do. | 9,000 | 4 00 | 92½ | .... | |
| 62 | 1857 | NEWCASTLE | Del. | 32,300 | 10 | 3 | Do. | 4,000 | 4 00 | 90 | .... | |
| 63 | 1847 | NEW HAVEN | Ct. | 250,000 | 25 | 4 | Do. | 30,000 | 3 00 | 155 | .... | None in market. |
| 64 | 1858 | NEW LONDON | Ct. | 70,000 | 50 | 3 | Do. | 12,000 | 4 00 | 105 | .... | Do. |
| 65 | 1835 | NEW ORLEANS | La. | 1,500,000 | 100 | 6 | Do. | 120,000 | 4 50 | 180 | .... | |
| 66 | 1858 | NEWPORT | R. I. | 180,200 | 100 | 4 | Do. | 10,000 | 3 50 | 112 | .... | |
| 67 | 1854 | NEWTON & WATERTOWN | Mass. | 300,000 | 100 | 2 | Do. | 10,000 | 4 00 | .... | .... | |
| 68 | | NEWTON | N. J. | 30,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 69 | | NEWTON | Pa. | 20,000 | 50 | — | Do. | 2,500 | 4 00 | .... | .... | |
| 270 | 1823 | NEW YORK | N. Y. | 1,000,000 | 50 | 5 | May & November. | 100,000 | 2 50 | 300 | .... | |
| 71 | 1859 | NIAGARA FALLS | N. Y. | 15,000 | 25 | — | Do. | 3,000 | 4 00 | 90 | .... | |
| 72 | | NORFOLK | Va. | 60,000 | 25 | — | Do. | 40,000 | 4 00 | .... | .... | |
| 73 | 1853 | NORRISTOWN | Pa. | 41,700 | 25 | 4 | June & December. | 8,000 | 3 50 | .... | .... | |
| 74 | 1855 | NORTH ATTLEBORO' | Mass. | 50,000 | 100 | 3 | Do. | 6,000 | 4 00 | .... | .... | |
| 75 | | NORTHERN LIBERTIES | Pa. | 400,600 | 25 | 7½ | City Works. | 40,000 | 2 50 | .... | .... | |
| 76 | | NORTH ADAMS | Mass. | 25,000 | — | — | March & September. | 30,000 | 4 00 | .... | .... | |
| 77 | 1856 | NORTHAMPTON | Mass. | 35,000 | 25 | 3 | January & July. | 4,500 | 4 00 | .... | .... | |
| 78 | 1859 | NORTH BRIDGEWATER | Mass. | 16,000 | 100 | 4 | June & December. | 1,000 | 7 00 | .... | .... | |
| 79 | 1856 | NORWALK | Ct. | 30,000 | 100 | 4 | February & August. | 6,000 | 4 00 | .... | .... | |
| 80 | 1859 | NORWALK | O. | 30,000 | 25 | — | January & July. | 4,000 | 4 00 | .... | .... | |
| 281 | 1854 | NORWICH | Ct. | 75,000 | 25 | 3½ | Do. | 12,000 | 3 50 | .... | .... | |
| 82 | 1861 | NORWICH | N. Y. | 12,000 | 50 | — | Do. | 2,500 | 4 00 | .... | .... | |
| 83 | 1859 | NYACK | N. Y. | 20,000 | 100 | — | Do. | 2,500 | 4 00 | .... | .... | |
| 84 | 1860 | OBERLIN | O. | 10,000 | — | — | Do. | 1,200 | 4 00 | .... | .... | |
| 85 | 1855 | OGDENSBURG | N. Y. | 75,000 | 50 | 5 | Do. | 9,000 | 4 00 | .... | .... | |
| 86 | 1859 | ORANGE | N. J. | 65,000 | 25 | — | Do. | 6,000 | 3 50 | .... | .... | Good works, built by Hoy, Jr., & Kennedy. |
| 87 | 1852 | OSWEGO | N. Y. | 81,250 | 100 | 3½ | Do. | 15,000 | 4 00 | 105 | .... | |
| 88 | 1855 | OTTAWA | Ill. | 45,000 | 100 | 6½ | Do. | 6,000 | 4 00 | .... | .... | |
| 89 | 1856 | OWEGO | N. Y. | 40,000 | 50 | 3½ | Do. | 5,000 | 4 00 | .... | .... | |
| 290 | 1860 | OWENSBORO' | Ky. | 25,000 | 25 | — | Do. | 4,000 | 3 50 | .... | .... | |
| 91 | 1856 | PADUCAH | Ky. | 75,000 | 100 | — | May & November. | 4,000 | 5 00 | .... | .... | |
| 92 | 1861 | PAINSVILLE | O. | 40,000 | 25 | 5 | Do. | 2,500 | 5 00 | .... | .... | |
| 93 | 1856 | PALMYRA | N. Y. | 12,000 | 25 | — | January & July. | 3,000 | 7 00 | .... | .... | |
| 94 | 1847 | PATERSON | N. J. | 125,000 | 25 | 3 | Do. | 20,000 | 3 50 | 95 | .... | Surplus $10,000, May 15, 1863. |
| 95 | 1850 | PAWTUCKET | R. I. | 75,000 | 50 | 4 | Do. | 12,000 | 3 00 | .... | .... | Works leased to Gilbert T. Sutton. |
| 96 | 1855 | PEEKSKILL | N. Y. | 31,000 | 50 | 3 | June & December. | 4,000 | 4 00 | .... | .... | |
| 97 | 1860 | PENN YAN | N. Y. | 12,000 | 50 | 5 | Do. | 3,000 | 4 00 | .... | .... | What is this Company doing? |
| 98 | 1859 | PEOPLES', CHICAGO | Ill. | 500,000 | 50 | New | Do. | 100,000 | 2 50 | .... | .... | |
| 99 | 1855 | PEORIA | Ill. | 100,000 | 50 | 4 | Do. | 8,000 | 3 50 | .... | .... | |
| 300 | 1852 | PETERSBURG | Va. | 120,000 | — | 5 | January & July. | 20,000 | 3 80 | .... | .... | |
| 1 | 1841 | PHILADELPHIA | Pa. | 3,000,000 | 50 | — | City Works. | 650,000 | 2 00 | .... | .... | |
| 2 | 1855 | PIQUA | O. | 50,000 | 50 | — | January & July. | 6,500 | 4 00 | .... | .... | |
| 3 | 1835 | PITTSBURG | Pa. | 300,000 | 100 | 5 | Do. | 60,000 | 1 50 | 115 | .... | |
| 4 | 1854 | PITTSFIELD | Mass. | 50,000 | 100 | 5 | Do. | 4,500 | 4 00 | .... | .... | |
| 5 | 1858 | PLACERVILLE | Cal. | 30,000 | 50 | — | Do. | 4,500 | 10 00 | .... | .... | |
| 6 | 1860 | PLAINFIELD | N. J. | 25,000 | 50 | — | Do. | 2,500 | 4 00 | .... | .... | |
| 7 | 1859 | PLATTSBURG | N. Y. | 16,000 | 50 | — | January & July. | 5,000 | 7 00 | .... | .... | |
| 8 | 1853 | PLYMOUTH | Mass. | 40,000 | 100 | — | April & October. | 8,000 | 4 00 | .... | .... | |
| 9 | 1860 | PORT CHESTER | N. Y. | 50,000 | 50 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 310 | 1860 | PORT JERVIS | N. Y. | 20,000 | 100 | — | Do. | 3,000 | 4 10 | .... | .... | |
| 11 | 1849 | PORTLAND | Me. | 300,000 | 50 | 4 | January & July. | 30,000 | 3 00 | .... | .... | |
| 12 | 1859 | PORTLAND | Oreg. | 50,000 | 50 | — | Do. | 3,500 | 8 00 | .... | .... | |
| 1 | 1859 | PORT LAVACCA | Texas. | 50,000 | 100 | — | Do. | 2,500 | 7 00 | .... | .... | |
| 14 | 1851 | PORTSMOUTH | N. H. | 70,000 | 100 | 8 | April & October. | 6,500 | 3 70 | .... | .... | |
| 15 | 1855 | PORTSMOUTH | O. | 50,000 | 50 | 4 | January & July. | 10,000 | 3 50 | .... | .... | |
| 16 | 1855 | PORTSMOUTH | Va. | 100,000 | 50 | 4 | Do. | 4,000 | 4 00 | .... | .... | |
| 17 | 1856 | POTTSTOWN | Pa. | 20,000 | 50 | 3 | Do. | 3,500 | 4 00 | .... | .... | |
| 18 | 1850 | POTTSVILLE | Pa. | 110,000 | 50 | 2 | Do. | 10,000 | 3 50 | .... | .... | |
| 19 | 1850 | POUGHKEEPSIE | N. Y. | 84,000 | 25 | 4 | March & September. | 15,000 | 3 50 | 120 | 110 | |
| 320 | 1848 | PROVIDENCE | R. I. | 1,000,000 | 50 | 4 | January & July. | 60,000 | 3 00 | 122 | .... | |
| 21 | 1858 | QUINCY | Ill. | 300,000 | 50 | 4 | June & December. | 12,000 | 3 50 | .... | .... | |
| 22 | | QUINCY | Mass. | 00,000 | 00 | — | Do. | 00,000 | 0 00 | .... | .... | |
| 23 | 1855 | RACINE | Wis. | 43,500 | 26 | — | Do. | 7,000 | 3 50 | .... | .... | |
| 24 | 1857 | RAHWAY | N. J. | 50,000 | 20 | — | January & July. | 5,000 | 4 00 | .... | .... | |
| 25 | 1858 | RALEIGH | N. C. | 25,000 | 100 | 6 | May & Novrmber. | 5,000 | 6 00 | .... | .... | |
| 26 | 1848 | READING | Pa. | 100,000 | 25 | 4 | January & July. | 25,000 | 3 00 | .... | .... | |
| 27 | 1851 | RICHMOND | Va. | 341,975 | — | — | City Works. | 30,000 | 3 00 | .... | .... | Jeff. Davis has extinguished the gas-lights of Richmond, Va. |
| 28 | 1859 | RICHMOND | Mass. | 40,000 | 25 | — | January & July. | 3,000 | 4 00 | .... | .... | |
| 29 | 1859 | RIPLEY | O. | 30,000 | 50 | — | Do. | 2,000 | 4 50 | .... | .... | |
| 330 | 1852 | ROCHESTER | N. Y. | 200,000 | 50 | 5 | Do. | 50,000 | 2 50 | .... | .... | |
| 31 | 1857 | ROCKFORD | Ill. | 40,000 | 50 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 32 | 1854 | ROCK ISLAND | Ill. | 100,000 | 50 | — | Do. | 6,000 | 4 50 | .... | .... | |
| 33 | 1854 | ROCKLAND | Me. | 50,000 | 100 | — | Do. | 6,000 | 4 40 | .... | .... | |
| 34 | 1852 | ROME | N. Y. | 35,000 | 100 | 3½ | Do. | 10,000 | 3 60 | .... | .... | |
| 35 | 1854 | RONDOUT and KINGSTON | N. Y. | 65,150 | 20 | 3¾ | June & December. | 10,000 | 3 80 | .... | .... | |
| 36 | 1854 | ROXBURY | Mass. | 150,000 | 100 | 5 | January & July. | 20,000 | 3 50 | .... | .... | |
| 37 | 1859 | RUTLAND | Vt. | 20,000 | 25 | — | Do. | 4,000 | 3 50 | .... | .... | |
| 38 | | SACO | Me. | 71,600 | 100 | 3½ | April & October. | 8,000 | 4 00 | .... | .... | |
| 39 | 1857 | SACRAMENTO | Cal. | 500,000 | 100 | — | Do. | 40,000 | 10 00 | .... | .... | |
| 340 | 1859 | SAG HARBOR | N. Y. | 20,000 | — | — | Do. | 4,000 | 4 00 | .... | .... | |
| 41 | 1858 | SAINT ALBANS | Vt. | 15,000 | 20 | — | Do. | 3,000 | 7 00 | .... | .... | |
| 42 | | SAINT JOHNSBURY | Vt. | 30,000 | 25 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 43 | 1857 | SAINT JOSEPH | Mo. | 50,000 | 100 | 5 | January & July. | 6,000 | 5 00 | .... | .... | |
| 44 | 1859 | SAINT LOUIS | Mo. | 600,000 | 50 | — | June & December. | 180,000 | 3 50 | .... | .... | |
| 45 | 1857 | SAINT PAUL | Min. | 200,000 | 50 | 3 | January & July. | 10,000 | 6 00 | .... | .... | Surplus $10,000, May 15, 1863. |
| 46 | 1856 | SALEM | N. J. | 30,000 | 25 | 3 | Do. | 5,000 | 3 86 | .... | .... | |
| 47 | 1850 | SALEM | Mass. | 200,000 | 100 | 4 | February & August. | 30,000 | 3 24 | .... | .... | |
| 48 | 1859 | SALEM | O. | 25,000 | 20 | — | Do. | 3,000 | 3 00 | .... | .... | |
| 49 | 1859 | SALISBURY | N. C. | 14,600 | 50 | 6 | May & November. | 3,500 | 6 00 | .... | .... | |
| 350 | | SALISBURY MILLS | Mass. | 1,250 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 51 | | SALMON FALLS | Me. | 25,000 | 100 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 52 | | SAN ANTONIO | Texas. | 75,000 | 20 | — | Do. | 40,000 | 6 00 | .... | .... | |
| 53 | | SAN DIEGO | Cal. | 30,000 | 50 | — | Do. | 50,000 | 10 00 | .... | .... | |
| 54 | 1854 | SANDUSKY | O. | 75,000 | 50 | — | April & October. | 9,000 | 3 00 | .... | .... | |
| 55 | 1859 | SANDWICH | Mass. | 10,000 | — | — | Private Works. | 2,000 | 3 50 | .... | .... | |
| 56 | 1852 | SAN FRANCISCO | Cal. | 1,000,000 | 100 | 6 | Do. | 50,000 | 8 00 | 110 | .... | |
| 57 | 1853 | SARATOGA SPRINGS | N. Y. | 39,000 | 100 | — | January & July. | 6,000 | 3 60 | 70 | .... | |
| 58 | | SAUGERTIES | N. Y. | 30,000 | 20 | — | Do. | 4,000 | 3 00 | .... | .... | |
| 59 | 1849 | SAVANNAH | Ga. | 200,000 | 25 | 5 | Do. | 10,000 | 3 75 | .... | .... | |
| 360 | 1851 | SCHENECTADY | N. Y. | 50,000 | — | — | Private Works. | 11,000 | 4 00 | .... | .... | |
| 61 | 1858 | SCRANTON, Gas and Water | Pa. | 100,000 | 25 | — | January & July. | 6,000 | 3 80 | .... | .... | About trying Water-Gas. |
| 62 | 1857 | SELMA | Ala. | 20,000 | 100 | — | Do. | 2,000 | 5 00 | .... | .... | |
| 63 | 1856 | SENECA FALLS AND WATERLOO | N. Y. | 80,000 | 50 | 3 | Do. | 10,000 | 4 00 | 100 | .... | |
| 64 | | SHREVEPORT | La. | 40,000 | 25 | — | Do. | 3,000 | 0 50 | .... | .... | |
| 65 | 1856 | SING SING | N. Y. | 40,000 | 100 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 66 | | SMYRNA | Del. | | | | | | 4 00 | .... | .... | Petroleum Gas. |
| 67 | 1860 | SOUTH ADAMS | Mass. | 10,000 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 68 | 1859 | SOUTH BRIDGE | Mass. | 5,000 | 25 | — | Do. | 4,010 | 6 00 | .... | .... | |
| 69 | | SOUTH BOSTON | Mass. | 200,000 | 50 | — | Do. | 60,000 | 3 25 | 110 | .... | |
| 370 | | SPRINGFIELD | O. | 200,000 | 100 | — | Do | 20,000 | 3 50 | .... | .... | |
| 71 | 1854 | SPRINGFIELD | Ill. | 75,000 | 50 | — | January & July. | 10,000 | 3 50 | .... | .... | |
| 72 | 1848 | SPRINGFIELD | Mass. | 100,000 | 500 | 5 | February & August. | 10,000 | 3 60 | 140 | .... | |
| 73 | 1855 | STAMFORD | Ct. | 6,250 | 25 | 5 | April & October. | 3,000 | 3 50 | .... | .... | |
| 74 | 1857 | STATEN ISLAND | N. Y. | 150,000 | 50 | 5 | January & July. | 26,000 | 4 00 | 95 | .... | |

## GAS-LIGHT COMPANIES IN THE UNITED STATES.—Continued.

*Compiled from official sources expressly for the* AMERICAN GAS-LIGHT JOURNAL.

CORRECTED BY JOHN B. MURRAY, No. 39 NASSAU STREET, NEW YORK, DEALER IN GAS-LIGHT SHARES.

| No. | Chartered. | Town. | State. | Chartered Capital. | Par Val. per Sh. $ | Semi-Ann'l Div'd. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 375 | 1859 | Staunton | Va. | 18,000 | 50 | 6 | January & July. | 4,000 | 7 00 | .... | .... | |
| 76 | | Steubenville | O. | 150,000 | 100 | — | Do. | 15,000 | 4 00 | .... | .... | |
| 77 | | Stockton | Cal. | 50,000 | — | — | Do. | 8,000 | 10 00 | | .... | |
| 78 | 1848 | Syracuse | N. Y. | 125,000 | 25 | 5 | March & September. | 25,000 | 3 00 | 112 | .... | |
| 79 | | Tamaqua | Pa. | 40,000 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 380 | 1859 | Tarrytown and Irvington | N. Y. | 70,000 | 50 | — | January & July. | 3,000 | 4 00 | .... | .... | |
| 81 | 1853 | Taunton | Mass. | 100,000 | 50 | 4 | Do. | 10,000 | 4 00 | .... | .... | |
| 82 | | Terre Haute | Ind. | 100,000 | 100 | — | Do. | 8,000 | 4 00 | .... | .... | |
| 83 | | Thompsonville | Ct. | 25,000 | 50 | — | Do. | 4,000 | 4 50 | .... | .... | |
| 84 | | Tiffin | O. | 25,000 | 20 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 85 | 1853 | Toledo | O. | 100,000 | 50 | 3 | Do. | 8,000 | 3 50 | .... | .... | |
| 86 | 1847 | Trenton | N. J. | 100,000 | 20 | 4 | Do. | 15,000 | 3 42 | .... | 110 | |
| 87 | 1848 | Troy | N. Y. | 200,000 | 100 | 4 | June & December. | 25,000 | 3 60 | 160 | .... | |
| 88 | 1856 | Urbana | O. | 30,000 | 25 | — | April & October. | 3,500 | 4 00 | .... | .... | |
| 89 | 1849 | Utica | N. Y. | 80,000 | 100 | 4 | Do. | 22,000 | 3 60 | .... | .... | |
| 390 | 1853 | Vicksburg | Miss. | 66,000 | 50 | — | March & September. | 4,000 | 4 50 | .... | .... | |
| 91 | 1859 | Vincennes | Ind. | 25,000 | 100 | — | January & July. | 2,000 | 4 00 | .... | .... | |
| 92 | 1858 | Walden | N. Y. | 2,500 | — | — | Private Works. | 1,000 | 6 00 | .... | .... | |
| 93 | 1853 | Waltham | Mass. | 100,000 | 100 | 4 | January & July. | 3,000 | 4 00 | .... | .... | |
| 94 | 1857 | Ware | Mass. | 30,000 | 20 | — | Do. | 3,500 | 4 00 | .... | .... | |
| 95 | 1861 | Warren | O. | 40,000 | 50 | — | Do. | 4,000 | 3 00 | .... | .... | |
| 96 | 1854 | Warren | R. I. | 20,000 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 97 | 1855 | Washington | D. C. | 500,000 | 20 | 5 | Do. | 50,000 | 3 25 | 150 | 148 | |
| 98 | 1859 | Washington | N. C. | 15,000 | 100 | — | April & October. | 1,500 | 6 00 | .... | .... | |
| 99 | 1848 | Washington | Pa. | 20,000 | 25 | 4 | January & July. | 4,000 | 3 00 | .... | .... | |
| 400 | 1854 | Waterbury | Ct. | 100,000 | 25 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 1 | 1852 | Waterford | N. Y. | 12,000 | 25 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 2 | 1852 | Watertown | N. Y. | 20,000 | 100 | — | Do. | 10,000 | 7 00 | .... | .... | |
| 3 | 1856 | Watertown | Wis. | 25,000 | 100 | — | Do. | 5,000 | 5 00 | .... | .... | |
| 4 | 1858 | Wautoma | Wis. | 30,000 | 50 | — | Do. | 3,000 | 4 50 | .... | .... | |
| 5 | 1857 | Waverly | Miss. | 20,000 | 100 | — | April & October. | 4,000 | 5 00 | .... | .... | |
| 6 | 1854 | West Cambridge | Mass. | 60,000 | 100 | — | February & August. | 10,000 | 4 00 | .... | .... | |
| 7 | 1852 | Westchester | Pa. | 100,000 | 25 | 2½ | Do. | 3,500 | 3 50 | .... | .... | |
| 8 | | Westfield | Mass. | 25,000 | 100 | 6 | Do. | 4,000 | 4 00 | .... | .... | |
| 9 | | Weston | O. | 20,000 | 25 | — | Do. | | 5 00 | .... | .... | |
| 410 | 1857 | West Point | N. Y. | 50,000 | — | — | United States Military | Academy. | 2 00 | .... | .... | |
| 11 | 1853 | West Troy | N. Y. | 100,000 | 50 | 3 | January & July. | 10,000 | 3 60 | 85 | .... | |
| 12 | 1850 | Wheeling | Va. | 75,000 | 25 | 6 | Do. | 12,000 | 2 70 | .... | .... | |
| 13 | | White Plains | N. Y. | 20,000 | 20 | — | Do. | | | .... | .... | |
| 14 | 1856 | Wilkesbarre | Pa. | 50,000 | 50 | — | May & November. | 4,000 | 3 33 | 100 | 80 | |
| 15 | 1850 | Williamsburg | N. Y. | 1,000,000 | 50 | 5 | January & July. | 60,000 | 3 00 | .... | .... | |
| 16 | 1858 | Williamsburg | Va. | 30,000 | 25 | — | Do. | 3,000 | 4 00 | .... | .... | Camp-fires of the Union Army light up this place at present. |
| 17 | 1857 | Williamsport | Pa. | 70,000 | 25 | 4 | Do. | 3,500 | 3 80 | .... | .... | |
| 18 | 1859 | Willimantic | Ct. | 12,000 | — | — | Do. | 2,500 | 3 50 | .... | .... | |
| 19 | 1853 | Wilmington | N. C. | 60,000 | 50 | 5 | Do. | 8,000 | 5 00 | .... | .... | |
| 420 | 1852 | Wilmington | Del. | 200,000 | 50 | 5 | February & August. | 20,000 | 3 00 | .... | .... | |
| 21 | 1854 | Winchester | Va. | 36,000 | 50 | 6 | January & July. | 5,000 | 4 00 | .... | .... | |
| 22 | | Woburn | Mass. | 20,000 | — | — | Do. | 3,000 | 4 00 | .... | .... | |
| 23 | 1856 | Woodstock | Vt. | 10,000 | 50 | 4 | Do. | 4,000 | 6 00 | .... | .... | |
| 24 | 1853 | Woonsocket | R. I. | 82,600 | 100 | 4 | April & October. | 4,000 | 3 50 | .... | .... | |
| 25 | 1856 | Wooster | O. | 25,000 | 50 | — | January & July. | 6,000 | 3 00 | .... | .... | |
| 26 | 1849 | Worcester | Mass. | 160,000 | 100 | 5 | Do. | 15,000 | 3 50 | .... | .... | |
| 27 | 1855 | Xenia | O. | 40,000 | 50 | — | Do. | 3,000 | 4 00 | .... | .... | |
| 28 | 1854 | Yonkers | N. Y. | 75,000 | 50 | 3½ | Do. | 6,500 | 4 00 | 102½ | .... | |
| 29 | 1849 | York | Pa. | 40,000 | 57 | 3 | June & December. | 10,000 | 3 50 | .... | .... | |
| 430 | | Yorkville | S. C. | 20,000 | 25 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 31 | 1858 | Ypsilanti | Mich. | 20,000 | 50 | 5 | February & August | 6,000 | 4 00 | .... | .... | |
| 32 | 1850 | Yreka | Cal. | 30,000 | 100 | — | Do. | 2,000 | 10 00 | .... | .... | |
| 33 | 1848 | Zanesville | O. | 44,600 | 25 | 4 | Do. | 10,000 | 3 50 | .... | .... | |

## GAS-LIGHT COMPANIES IN THE BRITISH PROVINCES OF NORTH AMERICA.

| No. | Chartered. | Town. | Province | Chartered Capital. | Par Val. per Sh. $ | Semi-An'l Div'd. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1854 | Belleville | C. W. | 33,040 | 100 | 4 | January & July. | 1,200 | 5 00 | .... | .... | |
| 2 | 1854 | Brantford | C. W. | 32,000 | 100 | 2¼ | Do. | | | .... | .... | |
| 3 | | Brockville | C. W. | 50,000 | — | — | Do. | 5,000 | 4 00 | .... | .... | |
| 4 | | Chatham | N. B. | 50,000 | — | — | | | | .... | .... | |
| 5 | 1854 | Charlotte Town | P. E. I. | 50,000 | 100 | 5 | Do. | 3,000 | 3 50 | .... | .... | |
| 6 | 1857 | Cobourg | C. W. | 30,000 | — | — | February & August. | 4,000 | | .... | .... | |
| 7 | | Dundas | C. W. | 30,000 | — | — | Do. | 6,000 | 4 00 | .... | .... | |
| 8 | | Frederick | N. B. | 50,000 | — | — | Do. | | | .... | .... | |
| 9 | 1843 | Halifax | N. S. | 160,000 | 40 | 7 | May. | 30,000 | 3 00 | .... | .... | |
| 10 | 1850 | Hamilton | C. W. | 125,000 | 40 | 5 | March & September. | 20,000 | 3 50 | .... | .... | |
| 11 | 1848 | Kingston | C. W. | 80,000 | 100 | — | Do. | 6,000 | 3 50 | .... | .... | |
| 12 | 1853 | London | C. W. | 100,000 | 20 | 5 | May & November. | 5,000 | 5 00 | .... | .... | |
| 13 | 1847 | Montreal | C. E. | 400,000 | 40 | — | March & September. | 110,000 | 2 80 | .... | 118 | Last sale at this figure. |
| 14 | 1854 | Ottawa | C. W. | 40,000 | 40 | 5 | Do. | 5,000 | 4 50 | .... | .... | |
| 15 | 1859 | Point Levi | C. E. | 25,000 | 25 | — | January & July. | 4,000 | 3 50 | .... | .... | |
| 16 | 1859 | Port Hope | C. W. | 28,000 | 20 | 4 | May & November. | 4,500 | 3 50 | .... | .... | |
| 17 | 1847 | Quebec | C. E. | 200,000 | 200 | 4 | January & July. | 60,000 | 3 00 | .... | .... | |
| 18 | 1848 | Saint Catherine's | C. W. | 80,000 | 20 | — | May & November. | 7,000 | 4 50 | .... | .... | |
| 19 | 1859 | Saint Hyacinthe | C. E. | 15,000 | 20 | — | Do. | 4,000 | 4 00 | .... | .... | |
| 20 | | Saint John | N. B. | 170,000 | 85 | — | June & December. | 25,000 | 3 50 | 110 | 110 | Sales at this figure. |
| 21 | | Saint John's | N. F. | 50,000 | — | 4 | Do. | 30,000 | | .... | .... | |
| 22 | 1858 | Sorel | C. E. | 14,000 | 20 | 4 | Do. | 4,000 | 3 00 | .... | .... | |
| 23 | 1848 | Toronto | C. W. | 400,000 | 100 | 4 | February & August. | 50,000 | 3 33½ | .... | .... | |

## GAS-LIGHT COMPANIES IN CUBA, MEXICO, SOUTH AMERICA AND NEW ZEALAND.

| No. | Chartered. | Town. | State. | Chartered Capital. | Par Val. per Sh. $ | Semi-An'l Div'd. | Dividends Payable. | Population of Gas District. | Price per 1000 Feet. | Asked pr. cent. | Offered pr. cent. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | Callao | Chile. | | — | — | January & July. | 20,000 | 7 00 | .... | .... | |
| 2 | | Cardenas | Cuba. | 50,000 | — | — | Do. | 180,000 | 5 00 | .... | .... | |
| 3 | 1857 | Compania Cubana | Hav'a | 500,000 | 500 | 10 | Do. | | | .... | .... | |
| 4 | | Cienfuegos | Cuba. | | — | — | Do. | 12,000 | 5 00 | .... | .... | These four towns are lighted by the Compania Cubana of Havana. |
| 5 | | Guanabacoa | Cuba. | | — | — | Do. | 14,000 | 5 50 | .... | .... | |
| 6 | | Regla | Cuba. | | — | — | Do. | 10,000 | 5 00 | .... | .... | |
| 7 | | Trinidad | Cuba. | | — | — | Do. | 16,000 | 5 00 | .... | .... | |
| 8 | | Guyaquil | S. A. | 150,000 | — | — | Do. | 25,000 | | .... | .... | |
| 9 | | Havana | Cuba. | 1,250,000 | 500 | 7½ | Do. | 300,000 | 5 00 | .... | .... | |
| 10 | | Lima | Peru. | 100,000 | — | — | Do. | 150,000 | | .... | .... | |
| 11 | | Maranham (Chartered) | | | — | — | Do. | | | .... | .... | |
| 12 | | Matanzas | Cuba. | 50,000 | — | — | Do. | 180,000 | 8 50 | .... | .... | |
| 13 | | Mexico City | Mex. | 550,000 | — | — | Do. | | | .... | .... | |
| 14 | | Montevideo | S. A. | 500,000 | — | — | Do. | | | .... | .... | |
| 15 | | Para (Chartered) | | | — | — | Do. | | | .... | .... | |
| 16 | 1854 | Rio de Janeiro | S. A. | 1,200,000 | 500 | 7½ | Do. | 300,000 | 4 00 | .... | .... | |
| 17 | | San Iago | Chile. | 500,000 | — | — | Do. | 180,000 | 7 00 | .... | .... | |
| 18 | 1857 | Saint Jago de Cuba | Cuba. | 450,000 | 500 | — | Do. | 25,000 | 5 00 | .... | .... | |
| 19 | | Valparaiso | Chile. | 500,000 | — | — | Do. | 85,000 | 6 00 | .... | .... | |
| 20 | | Vera Cruz | Mex. | 500,000 | — | — | Do. | | | .... | .... | |
| 21 | | Ville Clara | Cuba. | 50,000 | — | — | Do. | | | .... | .... | |
| 22 | | Auckland | N. Z. | | — | — | | | | .... | .... | |

## NEW GAS-ENGINE.

A recent number of *La Presse Scientifique* contains an excellent paper, by MM. Bontemps and Barral, on the new gas-power engine invented by M. Hugon—a subject which possesses so much interest to the generality of our readers that we devote a considerable space to a description of the machine, and an explanation of the principles on which its action is founded.

When heat is employed to produce a mechanical power, a term of comparison between the different kinds of machines chosen for the purpose is taken, to ascertain the quantity of heat capable of producing a determined effect. But this comparison does not alone suffice; and it is necessary to complete the economical calculation by the calculation of the price of the heat, which varies according to the combustible employed. This method applied to the comparison of the steam-engine with the various gas-machines hitherto tried, has sufficed to show the notable inferiority of the latter in respect of their yield. It has been decided, after sufficiently long experiments, made with every possible precaution, that their use could at present be recommended in cases where a small force only was required, and in which the conditions of installing the machine would not admit of the use of ordinary steam-engines. This modest part, after the first promises, was, nevertheless, sufficiently large, on account of the number of cases for which the use of the new motive power seemed to be naturally pointed out; but it appeared that the steam-engine had effectually excluded the new source of power in the majority of cases. The gas-power engine, which will be now investigated, has, however, put in question the conclusions derived from the first experiments, and has proved that it was possible to obtain from gas employed as a combustible more satisfactory results than were expected.

The new principle that has allowed the necessary improvements to be effected is the substitution of an indirect action, exercised through the medium of water, for the direct action produced upon the surface of the piston at the moment of the explosion of the detonating mixture. In the present system, the cylinder in which the piston moves is separated from the tubes where the explosion takes place; the force of projection resulting from the dilatation of the gas is employed to expel a certain quantity of water from the tube where the combustion is effected, and to produce a vacuum whose effect is added to that caused by the condensation of the vapor of water arising from the combination of hydrogen and oxygen, and which can be used in the cylinder. The different receptacles are, moreover, disposed so that the same water circulates through the different parts of the machine, and that the water which is expelled from the tube returns to fill up the cylinder on the side opposed to the chamber, which is at that moment in connection with the vacuum produced. The cylinder being primarily full of water, it is the tendency of the liquid contained in one of the chambers towards the vacuum that determines the motion of the piston; as to the water expelled from the tube, which fills the opposite chamber, whose capacity augments gradually, it enables the chamber to act on the return stroke, like the first.

This mode of the application of the considerable force, set in motion at the moment of the combination of the gas, appears to have the following advantages over the old system: Firstly, the shock produced by the rapid dilatation of the mixture is not immediately transmitted to the organs of movement; this force is transmitted to a liquid which is independent, and which displaces itself freely under the influence of the compression exercised upon its surface. A more useful effect ought thus to be obtained, by avoiding the vibrations which necessarily absorb a great quantity, in the mode of action, upon the solid organs. The contact of the remains of the gas with the water, whose temperature never exceeds 133° Fahr. (as we shall see in the sequel), allows the vapor to condense in part, and to augment the vacuum due to expansion. As to the use to be made of the vacuum itself, it is rendered as perfect as possible by the presence of water in all parts of the machine, for it is never augmented by the columns of the liquid whose movements determine that of the piston.

The second division of the article from which this is abstracted is devoted to recording the results of previous efforts; and the authors have described, in some detail, Lenoir's gas-power engine, reported upon, as our readers are aware, by M. Fresca. The official recognition of the powers of this engine gave rise to some claims to the merit of the invention, in which M. Hugon was himself concerned. But M. Hugon thought that the machine in question was so defective, that he set to work to discover a more perfect one, in which (according to the authors) he has succeeded, if the figures quoted can be relied upon. M. Hugon has preserved specimens of his engines from the year 1853 to the present day, so that the student can trace the gradual development of the idea, and can identify the various stages of the discovery. The authors of the article give some curious illustrations of this system; but, for our purpose, it is necessary only to deal with the perfect machine, as M. Hugon now presents it to the world; the methods by which he has arrived at the system adopted may, for the present, be passed over, and the machine, such as it was patented in 1860, may be at once described.

The generator, which corresponds with the boiler of steam-engines, is a curved tube, in the form of the letter U; the summit of the smaller arm bears the valves of escape and of introduction, and the larger arm is provided with clacks, which remain closed by their own weight. The clacks open in the bottom of an upper reservoir. In a certain part (which is variable) of the great arm of the U tube is placed a swelling, which serves to connect the tube with the cylinder. This is similar to the cylinder of a steam-engine, with this exception, that it bears two openings for the introduction, and two for the escape, of the liquid. Over these orifices are placed four slides, two of them being in communication with the vacuum tube, and two with a basin in which the water driven from the tubes can be evacuated, this water being firstly poured out in the reservoir which surmounts the large arm of the U, and then passed into the basin by an overflow-pipe. The piston communicates the motion to a first-motion shaft, upon which are geared the different machines for giving movement to the pumps, or bellows, of air or of gas, as well as to the different slides of the tube or cylinder.

We have supposed that there was only one generator, but, in fact, in the machine which we are now describing, there are two juxtaposed, and acting together alternately, as we shall see, and there is no reason why there should not be a greater number. The great branches of the two tubes are united by special swellings to a common pipe, which is intended to transmit to the cylinder the vacuum produced by means of the two slides disposed for that purpose. A particular mode of closing, which it is easy to conceive, placed at the spot where each swelling would open into the common pipe, may, by the motion of the clacks, put one or the other generators in connection with the cylinder, at the moment when the vacuum is produced, by isolating the others. Lastly, the valves interposed on the tube of communication, to which these swellings are connected, serve to set the machine in motion, or to stop it, by permitting, or stopping, the circulation of the water.

To cause the machine to work, it is necessary to fill with water the U tubes, the reservoir up to the overflow-pipe, the swellings that put the second branches of the two generators in communication with the cylinder, the cylinder itself, and the basin, up to a certain point. When the various organs of the machine are filled with water, a certain quantity of the explosive mixture is introduced by the valves at the top of the first generator, whose ignition is determined by the electrical spark, or by an incandescent platinum wire, or by a gas-jet. In the last case a slide, which performs the office of lighting the mixture, mounted with a jet, is advanced towards the mixture, by an opening which is laid bare by its own movement; it then retires, thus cutting off the preceding opening, and relights its own gas extinguished by the explosion, at a permanent light. The dilatation of the gases, carried immediately to a very high temperature, drives a certain portion of the water of the generator with great force through the clacks of the great branch, into the higher reservoir, which, in its turn, allows it to flow into the great basin.

But, after a short time, the gas left becomes cold, and the vapor of the water becomes condensed over the water. The clacks previously opened then close, and there is a vacuum produced in the generator that may vary from 4 inches to 2 feet 4 inches of mercury. At this moment the clacks which cause the swelling of the generator to communicate with the common conduit-pipe, open by the effect of the vacuum, whilst those which correspond with the second U tube remain closed. The valves are then opened, and the piston is advanced by the motion of the slides, in consequence of the vacuum upon one face, and on the other by the water exposed to the atmospheric pressure, with a force equal to the difference of the pressures exercised on the two sides, or, to speak more plainly, with a force equal to that of the vacuum produced.

The piston, in advancing, causes the water which is upon the face directed towards the vacuum to replace a certain portion of that which had been driven out of the generator by the combination of the gases. When it arrives at the end of its stroke the movement of the slides is reversed—the face originally in contact with the vacuum is placed in contact with the water in the basin, whilst the other communicates with the vacuum. The piston then returns upon the stroke, and the water of the chamber, whose capacity has diminished, is introduced to supply the void then existing in the generator. If, during this movement of the piston, a certain quantity of the mixture is introduced into the second generator, and this mixture is ignited at the moment that the machine finishes its entire course, and is at its dead point, the same effect is produced by the second generator which had previously been produced by the first—the machine will continue to move, and it will be the same with as many generators as it may be decided to employ.

But, whilst the first generator is working the machine, the escape-valve of the small branch is opened, and, by means of a rod moved by an eccentric fixed to the wheel, one of the slide-valves of the great arm is equally raised. The difference of level existing between the small branch and the surface of the reservoir determines a pressure, which drives through the escape-valves the residue of the gases into the chimney. The escape-valves then close; the valves, through which the inflammable mixture is introduced—to be lighted in proper time, as has been explained—are then opened, and the same movements are repeated indefinitely for each tube.

The speed of rotation of the machine will depend upon the number of the generating tubes, and the dimensions and forms of the openings for the introduction and the escape of the water of the cylinder. The capacity of the tubes, with reference to the vacuum therein produced, may be represented at will either by an entire revolution of the machine or twice the volume of the cylinder, or by half that revolution or once that volume. In this last case it will be necessary to diminish the velocity, without which the escape would not be effected under good conditions. In the case of the tube representing the entire revolution of the machine—if great velocity is not required, two tubes, or one tube divided into two, would suffice. The number of generators would be augmented, if a more rapid motion were required.

By means of the pumps and bellows of air and of gas, by which the length of the stroke of the piston is regulated at will, it is also possible to regulate the quantity and quality of the mixture to be introduced, according to the work required. The position and the form of the generators may vary in an infinite number of manners; the valves may be replaced by corks or clacks; lastly, all the details of the transmission are, as may easily be understood, susceptible of being modified in a great number of ways. Amongst all these dispositions, we will content ourselves with remarking a particular form of slide-valve, which, instead of being formed of one piece, presents several openings. Great advantage is derived from their use; the communication they establish is opened and shut quicker and in a more perfect manner, and it is not necessary to make them travel a longer path than, under the circumstances of their movement, would be inconvenient, one of their faces being exposed to a vacuum, and the other to a counter-pressure.

The gas-power engine thus described does not produce any vibration, or shock of any kind; the heating

of the water of circulation, after a day's work, never exceeds 133° Fahr.; and the consumption of gas is about 53 or 56 cubic feet per horse-power per hour, whilst the consumption of gas by Lenoir's machine was never less than 88 cubic feet per horse-power per hour. We shall return to these results; we will cite the experiments made, and submit them to calculation. The numbers that they will furnish will enable us to indicate very exactly what is the economical value of the new motive power thus placed at our disposal.—*Journal of Gas Lighting.*

## ON DESTRUCTIVE DISTILLATION, CONSIDERED IN REFERENCE TO MODERN INDUSTRIAL ARTS.*

BY B. H. PAUL, PH.D.

The effects produced by the application of heat to various substances must have been amongst the earliest observed chemical phenomena. The differences existing between the effects produced by heat upon different substances were recognised at a very remote period in the history of chemistry, and among them the phenomena of distillation received especial attention. In some cases the application of heat to a substance has the effect of dissipating it entirely; such substances, of which water is a familiar example, are said to be volatile, and if substances of this kind are heated in closed vessels of suitable construction they may be recovered again, in their original condition, by the condensation of their vapor. This, in the strictest sense of the term, constitutes distillation. The volatile substance, absorbing the heat applied to it, because converted into vapor; by abstracting from that vapor the heat which has been absorbed, it is converted into the original substance. In this way distillation is employed as a means of separating volatile substances from others which are not volatile, and which are, in contradistinction, termed fixed substances. This distinction between fixed and volatile substances is, however, in most cases merely relative, and it applies only to such a range of temperature as is commonly attainable. There are good reasons for the opinion that the substances commonly regarded as fixed, might be converted into vapor if their temperature could be increased to a sufficient degree. But among the substances which, in this limited sense, are termed fixed, there are some which certainly cannot be converted into vapor, in any case, without entirely losing their identity; without, in other words, being converted into totally different substances. Thus, for instance, wood is not a volatile substance, and at the same time it is not a fixed substance, except within a certain limited range of temperature. When heated much above the boiling point of water, wood is partially converted into vapor, to an extent proportionate to the temperature employed, but the vapor so produced cannot be reconverted into wood by cooling it, as the vapor of water can be reconverted into water. The change produced by the heating is a true chemical change. Most substances analogous to wood undergo a change of this nature when heated in close vessels; they are, in chemical language, decomposed, and the substances into which they are converted are called the products of the decomposition. These products are partly volatile. It is only in this way that substances which are not in themselves volatile can be said to distil, and it is this conversion of substances, by the application of heat, into new substances, that constitutes what is termed destructive distillation.

The products of this alteration present, in all cases, a general similarity. There is, in the first place, the carbonaceous residue, which cannot be volatilized—the "coal," as it was formerly called. Amongst the volatile products, water and oil are conspicuous; there are generally some substances dissolved in the water, communicating to it peculiar characters, according to the nature of the material distilled, and in all instances some gas is produced.

In the earlier days of chemistry the destructive distillation of organic substances was considered to effect a separation of their component parts; it was looked upon as a means of analyzing both vegetable and animal substances. But it was found that the products of the destructive distillation of a substance varied in amount according to the heat applied to it, and, consequently, when quantitative relations become an important consideration in chemistry, this opinion was abandoned, and it has long since been generally admitted that the alteration of such substances undergo in destructive distillation is greater than a mere separation of pre-existing components—that it consists in an entire destruction of the original substance, with simultaneous production of new substances.

This decomposition of an organic substance by heat consists in a disturbance of the chemical equilibrium upon which its existence depends; the products to which it gives rise are substances capable of existing at the higher temperature. All organic substances are characterized by their liability to decomposition by heat, but they differ among each other very much in their capability of supporting heat, or in other words, in their liability to decomposition under its influence. For every organic substance there is a particular range of temperature within which its existence is possible, and beyond the higher limit of which it undergoes decomposition. Hence there is an intimate and essential connection between the nature of the products and the temperature of the decomposition, and it follows that the special nature of the products obtainable in destructive distillation differs, according to the temperature at which it is conducted, no less than according to the material from which they are obtained. These features of the decomposition of organic substances by heat were very clearly recognized by Lavoisier; they received at his hands considerable attention, and though they did not occupy a prominent place in the chemical phenomena that, in his time, were the object of general interest, his works contain important discussions as to the causes to which they were referable.

Prior to the time when Lavoisier wrote on this subject, the product of destructive distillation to which—with some few exceptions which I shall afterwards notice—most attention was directed, was the oily product. The characters of the oil obtained by this means from different substances are often described in old chemical works. Sometimes it was called tar, that term being applied to those kinds of pyro-oils which were resinous and dried up by exposure to air, as in the case of that obtained from pine-wood, and which at the present time is still commonly known as tar. Some of these pyro-oils figure as medicinal agents in the pharmacopœia of 1678, and amongst others the oil of coal—which is described as a fossil bitumen, bearing the names of carbo petræ, lithanthrax, seal-coal, or Newcastle coal—and the direction given is that "you may distil it as amber, so shall you have a spirit and oil." But this oil of coals soon became a matter of more extended observation, in consequence of the attempts made to use pit-coal as fuel in smelting. For a long time these attempts were unsuccessful. At length, however, a method was found of removing the disadvantages of coal for smelting purposes. That method, as every one knows, was coking. The discovery of this method has been ascribed to Becher, who was in England about the year 1665, but he says himself that it was a German, of the name of Blavesten, who first suggested the idea of employing what he called "stone charcoal" for smelting iron. In any case the oily product obtained from the coal, by heating it in close vessels, attracted the attention of Becher, and he put forward a project for making tar from coal, apparently in conjunction with the production of coke which is very often referred to in old works, but always in very vague terms, and nothing much seems to have come of it.

The German chemist Neumann examined the oily products of the distillation of coal, and described them in his works as consisting of a "thin fluid oil" and another "thick pitchy oil." He obtained these by distilling the coal of Halle "with a fire gradually increased," and he states that "the coal, during the distillation, looked like melted pitch." Still these products were not turned to any useful purpose.

However, the coking of coal, or the desulphurizing, as it was sometimes called, became an important operation, and great interest was excited by it on the Continent. In 1765, the French Government thought it desirable to send a commission to this country, for the purpose of learning the art of coking. An account of their observations is given by M. Jars, the brother of one of the commissioners. He says: "The English were the first to attempt rendering coal available for smelting purposes; the first trials are of a very remote date. And, among others, Swedenborg speaks of it as an art which in his time was not fully developed. But the industry of the English overcame all difficulties, and they succeeded, by means of very simple operations, in attaining the desired end, that is to say, in depriving pit-coal of the defects which render it unfit for smelting." The attempt to turn to account the volatile oily products obtained in coking coal was still continued, both in this country and on the Continent. At Liege, for instance, coal was distilled for oil, and similar attempts were made likewise in various parts of England, by the Marquis of Rockingham, near Sheffield, by a Dutchman named Van Haak, at Coalbrookdale and Newcastle, and by others.

One of the best known instances of the application of these volatile properties of coal, was one carried out in Nassau, shortly before the year 1768, at some iron works belonging to the Prince of Nassau-Saarbruck, at Sultzbach. This plan was described by M. Genssane to the French Académie des Sciences, and reported upon by Macquer. He says: "The whole art of the preparation of pit-coal, so as to render it fit for smelting, consists in depriving it of the bituminous and sulphury substances which render it too fat and energetic when it is used in its natural state. * * * This principle once established, it is easy to conceive that it is only by distillation and evaporation that these two substances can be separated from the coal."

The distillation of coal at these works was conducted in a kind of close oven, or muffle, heated externally by furnaces. "The fire was got up gradually, until the oven became slightly red-hot, and it was then kept at that degree. * * * The heat being gradually communicated to the coal within the oven, first of all expelled its bituminous portion, which distilled off through a pipe, and fell into a receiver; when the coal had given off its bitumen it commenced to become slightly red-hot.

"The oil and bitumen obtained in this operation almost paid the cost of it. * * * The pure bitumen was very thick and greasy, and equal to the best carriage grease. * * The oil did not differ from that obtained by distilling petroleum, except in being much less readily inflammable than the latter, and it could be advantageously employed in lamps by the country people. Nothing else was used for burning in the mines at Sultzbach."

MM. Macquer and Montigny, in reporting to the Académie on this manufacture, speak highly of its utility, and when we consider the extent to which the manufacture of which this was the first germ, has now grown, it appears that their opinion was well founded.

The next person who made a step in this branch of manufacture was Lord Dundonald. The preparation of coke appears to have been still the predominating idea, but it was also thought that the volatile substances given off in this operation might be turned to account, as well as the coke. All the previous methods of obtaining these products consisted in distilling coal in close vessels heated externally, but Lord Dundonald's method consisted in partially burning the coal in a large chamber capable of being entirely closed, and admitting a regulated supply of air, just sufficient for maintaining the combustion of coal at the desired degree. The volatile products from the coal passed away through a pipe to a condenser, where they were collected. An account of the works erected on this plan at upper Cranston, is given in Sir John Sinclair's "Statistical Account of Scotland." The product obtained, besides coke, was a mixture of tar and water. This first product was submitted to distillation, yielding an oil lighter than water, and a solution of ammonia. This tar was sold for greasing cart wheels, at the rate of sixpence per Scotch pint. When the distillation was continued for four and a half days, the residue, remaining in the still, was the tar suitable for coating ships, which was regarded as one of the most important of the products. When the distillation was continued for five and a half days, the residue in the still was more pitchy; and after six and a half days it was quite brittle.

*(To be continued.)*

* Read before the Society of Arts, of London, May 27, 1863.

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THE

# AMERICAN GAS-LIGHT JOURNAL,

PUBLISHED ON 1ST AND 15TH OF EVERY MONTH.

C. ELTON BUCK, . . . . . EDITOR.

WEDNESDAY, JULY 15, 1863.

The often agitated, but as often silenced question of the extra carburation of gas, by means of naphtha or some equivalent hydrocarbon, is beginning to attract some attention in several European countries, and there are a few advocates of the plan in this country who join in with the promoters of the scheme. At repeated intervals since the first introduction of gas-light, this subject has filled the minds of experimenters, and countless devices have been suggested, whereby a large gain in illuminating power might be obtained at a comparatively trifling cost. Inventors have pursued their studies in this field with all the infatuation of the lost traveller who mistakes the *ignis fatuus* for a veritable light, and, like the traveller pursuing the phantom, they have been as often led astray and enticed beyond their depth, to regain a foothold only after hard struggling.

It must be confessed that, at first sight, there is something very captivating in the idea of being able to increase the illuminating power of gas by a process apparently so simple and inexpensive as that of naphthalizing it. But after some little investigation into the merits of such plans, they are found to be almost wholly inoperative. We do not by any means wish to be understood as saying that naphthalizing cannot be accomplished—for we have seen various devices for effecting this purpose—nearly all of which, for the time, worked well. But we do mean to say that, *practically*, naphthalization or carburation is a failure. It is troublesome, costly, and, in the hands of inexperienced persons, dangerous.

The idea of gas carburation was first suggested by Mr. LOWE, the well-known English gas-engineer, who, many years ago, endeavored by means of several devices, to enrich ordinary coal-gas with the vapors of naphtha. Among other opponents to this idea, the insurance companies made formidable remonstrances against its being carried into effect, claiming that the danger incurred was sufficient to justify them in cancelling their policies in all premises where the process was used. Mr. LOWE used various forms of apparatus for effecting his object. One was a gas meter filled with naphtha instead of water, and so arranged that the measuring and naphthalizing of the gas could go on co-incidentally. This plan, however, totally failed; principally by reason of the ready volatility of the naphtha, thus lessening the amount of sealing liquid in the meter, and diminishing its reliability.

Another project of Mr. LOWE's was to cause the gas to pass through a box containing a number of shelves, on which were placed pieces of cloth or other absorbent material for diffusing the vapor of the naphtha. The shelves in the box were so arranged as to cause the gas to traverse the length of the same over each shelf, and thus to be exposed to the action of the volatile hydrocarbon. This apparatus soon followed the others which had been pronounced impracticable.

The principal difficulty experienced in naphthalizing gas is that of the chemical nature of the substances usually employed. Thus, in the case of Mr. LOWE, coal-tar naphtha was used. This liquid is not a homogenous body, but is composed of a mixture of unequally volatile hydrocarbons—the more etherial of which evaporate first, leaving the remainder in a fluid state, and in no condition to impart additional brilliancy to the gas. Again, the less volatile portion of the naphtha, although some of it may be taken up by the gas under certain circumstances, exhibits a great proneness to condense in the pipes and fittings before reaching the burners. This is a great source of annoyance, and has been productive of repeated obstructions in pipes, causing, for the time, a total stoppage of the flow of gas. This result is analogous to the action of imperfectly condensed and washed gas made from crude petroleum. The effect and cause are both the same. The superior brilliancy of petroleum gas is due to the presence of these hydrocarbon vapors, and on any sudden change of temperature, and sometimes apparently without cause, they clog up the pipes as they did last December at the St. Nicholas hotel, in this city.

Among other patentees who have proposed the carburation of coal-gas, may be mentioned the names of MOLLERAT (1834), MANSFIELD (1847), and ADAMS (1851). There may be others who should be mentioned in this connection, but these are all which occur to us now.

MANSFIELD proposed to use benzole for enriching the flame of coal-gas. This is an extremely volatile liquid—so much so, in fact, as to interpose great obstacles in the way of its employment. MANSFIELD found that the rapid evolution of vapor from benzole created such a degree of cold as to cause the remaining portion to become solid, or nearly so, and thus to be of little or no effect. The plan was then suggested of placing the reservoir containing the benzole above the flame of the gas, so that it might be heated, and thus prevented from solidifying. A few explosions soon taught the danger of this expedient; and yet we have seen it recommended to fix reservoirs of hydrocarbon in this manner in the street lamps of London, where the carburation process is now being tried.

Quite recently, a Frenchman, named MONGRUEL, has invented a "photogenic gas." We have before expressed our views of this invention, and declared our opinion of its worthlessness. We are glad to see some of the ablest scientific journals of England concur in our views. The *Chemical News* regards M. MONGRUEL as the inventor of a "mere apparatus for effecting a result which, if desirable, might be easily obtained by many other means far less costly, and probably not at all less efficient." The *Ironmonger* also regards the plan of M. MONGRUEL as altogether old and of very little value.

The Rev. W. R. BOWDITCH, whom our readers will remember as a clerical inventor pursuing gas researches, and as the patentee of some purifying processes, about which much difference of opinion prevails, has also patented a new plan for naphthalizing gas.

Mr. BOWDITCH describes his invention as consisting—

"In applying heat to vaporize and keep vaporous the hydrocarbons employed for carbureting or naphthalizing gas for illumination, and in passing gas, before it is burned, through or over the heated hydrocarbons; also, in heating the hydrocarbons, and keeping the volatile products hot by the gas flame itself, and in improved apparatus."

We have not seen the apparatus used to carry out this invention, nor would we want to have one very near us, unless we were to desire to be occasionally blown up by way of variety. Such expedients are dangerous even when managed by persons well aware of their liability to explode, while in the hands of servants they would be unsafe in the last degree. We therefore think this plan can never meet with much success.

The danger attending the promiscuous use of the volatile hydrocarbons cannot be too emphatically dwelt upon. They are very inflammable, and their vapor when mixed with atmospheric air is highly explosive. In the carburation of gas it would be necessary to use some of these hazardous substances. This danger, even if all other requirements were fulfilled, would have the effect of greatly retarding the use of the system of carburation in which their presence is necessary. The present excitement over M. MONGRUEL and his "invention" will soon die out in England, and then we shall, doubtless, have occasion to note down some other attempt to bamboozle the shrewd people of that Island.

## OUR POST-OFFICE DEPARTMENT.

On the 26th day of March, of this year a package of newspapers was mailed in Philadelphia, legibly directed to our address in this city. On the afternoon of July 11th, of the same year, the package was delivered to us from our box in the Post-Office, it having been just *three months and fifteen days* in possession of the postal authorities, ere reaching our hands. What wonderful despatch!

We must be very careful not to complain of this, however. If the package was *slow*, it was, also, *sure*, and reached us in safety, although a long time on the way. If all our missing papers and letters would turn up at the end of a few months safe and sound, we would try and hold our peace, and not make more than a reasonable complaint. But having repeatedly missed valuable letters known to have been sent us—some of them containing considerable sums of money—as well as papers and pamphlets of great value to us, it cannot be denied that we have a right to denounce the abominable mismanagement *somewhere* in the Post-Office department. Exactly where this mismanagement is we cannot say, but we aver that the Post-Office of this city deservedly comes in for a share of reprehension. Drop-letters which ought to be received the evening of the day on which they were mailed, are sometimes several days, and we have known them to be a week on the way.

We have been frequently inconvenienced by this disgraceful state of affairs, and it is high time that incompetency and political favoritism were weeded out of the department, and good honest business men selected to fill the vacancies. It is provoking beyond degree to be so frequently annoyed at the shortcomings of those now in control of postal affairs. There should be an almost absolute certainty that letters or papers once dropped into a post-office box be promptly delivered. To say that at present, there is anything more than a probability of their reaching their destination, is simply ridiculous. We wish it were otherwise, but the truth, however unpleasant, must be told.

The monstrous political iniquity of appointing mere party hangers-on to places of trust and profit is at the bottom of all this trouble. The pestiferous doctrine that "to the victors belong the spoils" is closely adhered to by the dominent party, and while this pernicious practice is continued we can hope for but little change for the better. If good business men were put into the post-office, and continued there during good behavior, we would soon see a different state of things.

## FINANCIAL.

*Tuesday Evening, July 14th, 1863.*

The general share market, since our last issue, has undergone many fluctuations, and has experienced the varying phases of a stringent, as well as an abundant money market. The great successes obtained by our armies under General GRANT, at Vicksburg, and that under General Meade, at Gettysburg, together with the victory of PRENTISS over the rebel PRICE at Helena, and the steady advance of ROSECRANS in Tennessee, have each and all had a most exhilarating effect on the general tone of the market, greatly increasing public confidence, and bringing a large number of outside lenders into the street. Generally speaking, stocks have advanced, while the price of gold coin and foreign exchange have declined fully *twelve per cent.* All that is now wanted to depress these premiums still further, is another defeat of LEE, and the opening of the Mississippi by the capture of Port Hudson—events which we hope will soon take place.

We have frequently referred to the perfect independence of gas-light shares from all these sudden advances and declensions to which other securities are liable. This has been exemplified in a remarkable manner by the total lack of sympathy shown by gas with other stocks during the first year of the war, when panics were of frequent occurrence at the brokers' board. Although they may have declined, the figures at which they then sold were but slightly below those they brought long before the rebellion broke out, and while the value of leading railroad, bank and other shares exhibited a very mercurial state, the variations in the price of gas shares were but slight in comparison.

For the same reasons gas shares seldom advance in times of great inflation, with that rapidity which characterize the leading stocks in the market, but holding their own, they represent at all times an intrinsic value, uncontrolled by passing events.

Gas shares may be quoted as being remarkably quiet. Little or nothing has been done in them since our last report. The only sale of any consequence which has come under our notice, was a parcel of *Richmond County*, N. Y., on private terms.

Parcels of *Lafayette*, Ind., are still offered, as well as *Paterson*, N. J., and other companies of moderate size.

There is some inquiry for *Metropolitan*, N. Y., which is wanted for investment. This company have commenced operations, and will do a thriving business. They possess a district susceptible of greater improvement than any other in this city, and although it is yet not very thickly settled, it bids fair to be densely populated ere many years roll round.

## TO SUBSCRIBERS.

Those of our subscribers who have not yet remitted the amounts due by them, are requested to do so without delay. The terms of subscription of the greater portion of our patrons expired with the number for June 15th. A large number have responded to our demands with an alacrity which we heartily appreciate. We trust all others will do the same, and thus save us the necessity of discontinuing the paper to any of our former readers. We render *quid pro quo* for all that we ask, and promptness is all that we desire.

**NEW ENGLISH PETROLEUM GAS PATENT.—L. Davis and F. M. Parkes have obtained a patent in England for making, illuminating, and heating gas from petroleum, by submitting the material to destructive distillation in vertical iron retorts, and the gases and vapors there eliminated are reheated, by being passed a second time through the furnace and thence to the condensers and purifiers. We see no novelty nor value in this process.**

## ANSWERS TO CORRESPONDENTS.

J. G. E., of Pa.—*Your letter was not received in time for us to attend to your request. We hope your views will prove acceptable. We have sent the book by express.*

A. B. C., of Conn.—*We are as much in the dark relative to the affairs of the company as you are. Nothing of a reliable character can be obtained. Time will show it all.*

L. R. F., of R. I.—*We can recommend the process, as we have seen it in operation, and know it to be a success. By taking the trouble to visit the works you will be satisfied of its entire feasibility.*

J. P., of N. Y.—*It is a disputed question, very little understood by scientific men, and there are no rational explanation of the phenomenon with which we are acquainted. In this age of inquiry and experimental research, it cannot remain a mystery long.*

G. D. S., of Md.—*Our predictions were verified in every particular, and the change was made as we suggested it should have been months ago.*

S. S. D., of Ind.—*We have made the alteration, and are indebted for the information. The same parties are still in business, as you will see by reference to our advertising columns.*

C. B. E., of Mass.—*Nothing will ever come of it. It is not new, nor is it useful or safe. A few days' use of the apparatus will dispel all delusions respecting its value. We would advise you not to touch it.*

A. R. T., of Mo.—*We will make the inquiry from the proper authorities and reply by mail. We think there should be no danger from delay.*

J. J. C., of England.—*You are mistaken. Our remarks were not intended to cast a slur on English engineers, for we invited testimony from them to prove, if possible, their gas equal to ours. Any communications with which you may favor us shall be published conspicuously. Fair play is our motto, and we desire to observe it in every instance.*

## THE CHEMICAL PROGRESS OF GAS MANUFACTURE SINCE 1841.

BY JOHN LEIGH, ESQ., M. R. C. S., &C.

(*Concluded from page 7.*)

There can be little doubt that from the rapid removal of the gas from the retorts, still further facilitated by the rapidly rotating fan of the exhauster, and the cessation of all contact of the gas with unsaturated water, a corresponding improvement in the illuminating power of the gas would be found; and the analyses made subsequent to the alterations confirm this.

Before the introduction of the present mode of manufacturing and washing the gas, the illuminating gases—consisting of olefiant and other hydrocarbons—averaged about 6½ to 7 per cent. Afterwards, and to this time, they have averaged 8, 8½, and 9 per cent., indicating a great increase of illuminating power. The pressure thrown upon the retorts in the previous mode of manufacture, not only caused considerable leakage from the retort-mouths and from the pipes and apparatus till it had passed the purifiers, but the retention of the gas in the retorts had an injurious effect upon it, producing a partial decomposition of the olefiant and richer hydrocarbons into simpler and less illuminating hydrocarbons. A portion of the carbonaceous crust in the interior of the retorts is no doubt due to the decomposition by their heated surface of the richer hydrocarbons of the gas and a portion of the lighter oils of the tar.

A series of experiments had shown me that when the highly carbonated illuminating gases were exposed to a contact with a surface of a high temperature, whether of iron, coke, porcelain, or glass, a portion of their charcoal was separated and deposited on the heated surface, whilst the hydrogen (possessing no illuminating power) was set free; and that thus good gas might be rendered poor by too prolonged contact with a red-hot surface. For example, I enclosed fragments of iron, coke, charcoal, rock-crystal, lime, &c., severally in glass and porcelain, and iron tubes, and heated the tubes to redness. I then passed through the tubes a quantity of coal-gas, of olefiant gas, of the vapor of naphtha, &c., severally, when I found, on collecting the gas at the opposite extremity of the tubes, that a quantity of hydrogen had been liberated, derived from the destruction of the illuminating gases transmitted, whilst a portion of charcoal was deposited on the interior of the tubes and on the fragments contained within them. Here, then, was positive evidence of the injury which the gas must sustain by being retained in contact with the retorts; but, to bring the experiments to an exact parity with the process of gas-making, tubes were part filled with coal and cannel, one end hermetically sealed, and the other connected with a condensing and collecting apparatus.

In one experiment, the tube was heated to redness, beginning at the open end, so that as the heat was carried back, the gas eliminated from the coal or cannel had to pass over the red-hot coke formed in the first part of the tube.

In the second experiment with the same coal or cannel, the process was reversed, and the tube heated from the farthest end, so that the gas would be at once removed, and have to pass over merely the cold cannel or coal, and meet the cold sides of the remaining tube.

The results were very conclusive. In the second experiment, where the gas had to pass over no hot matter, nearly 9 per cent. of olefiant and other illuminating gases was obtained, whilst the residual gas, from which these had been removed, gave, on analysis:

| | | |
|---|---|---|
| Light carburetted hydrogen | 60.18 | per cent. |
| Hydrogen | 34.11 | " |
| Carbonic oxide | 5.35 | " |
| Nitrogen | 0.17 | " |

In the first experiment, where the gases had to pass over red-hot matter, only 4 per cent. of olefiant gas, &c., was obtained, whilst the remaining 96 parts of gave, on analysis:

| | | |
|---|---|---|
| Light carburetted hydrogen | 28.28 | per cent. |
| Hydrogen | 51.32 | " |
| Carbonic oxide | 16.40 | " |
| Nitrogen | 0.0 | " |

Nothing could better exhibit the necessity of exposing the gas as it is made as little as possible to the heated sides of the retort or the incandescent matter within, but of removing it as fast as possible from the retorts, and of relieving it from all pressure.

It may assist the comprehension of the purport of these experiments and of the evidence they afford, if I state that the gases eliminated in the distillation of coal and cannel consist of:

| | | |
|---|---|---|
| 1. Olefiant gas. | These give to the gas nearly all its illumination. | |
| 2. Associated rich hydrocarbons. | | |
| 3. Light carburetted hydrogen. | Giving a little light. | |
| 4. Hydrogen. | These three give no light. The two first are simple diluents of the others. The nitrogen may be regarded as an accidental constitutent. | |
| 5. Carbonic oxide. | | |
| 6. Nitrogen. | | |

The first two burn with a strong white light, and constitute the essential light-giving constituents of gas. Although this is the case, they form but a small proportion of the complex mixture of coal-gas. The best Wigan cannel-gas contains scarcely ever more than 9 per cent. of these illuminating constituents. The light carburetted hydrogen forms from 30 to 45 per cent. of coal-gas; it burns with a yellowish flame, and gives but little light; its co-efficient, however, has not been determined. The hydrogen and carbonic oxide compose the remaining gas. They give no light on combustion, having a faint blue flame. The light carburetted hydrogen and carbonic oxide may be regarded as mere diluents of the two first. The nitrogen, I believe, scarcely exists in gas, except as an accidental constituent derived from atmospheric air. An actual analysis will, perhaps, best exhibit the composition of a good Wigan gas, made at Manchester, at your works:

*Gas Dried and Freed from Carbonic Acid.*

| | | |
|---|---|---|
| *Olefiant gas and associated hydrocarbons* | 9.21 | per cent. |
| Oxygen | 0.16 | " |
| Nitrogen | 5.37 | " |
| Light carburetted hydrogen | 38.08 | " |
| Hydrogen | 42.33 | " |
| Carbonic oxide | 4.84 | " |
| | 99.99 | " |

Combined with these, and which ought to be removed in the process of purification, are carbonic acid, prussic acid, hydrosulphuric acid or sulphuretted hydrogen, ammonia in chemical union with the three preceding, forming salts, soluble in water, and sulphuret of carbon. The first three are at present removed by lime, the salts of ammonia by washing with gas-water, and that portion mechanically carried forward by the gas is removed by copperas. The sulphuret of carbon will, I expect, be removed by an apparatus now in course of construction, by a method of mine which has recently been before the committee.

To test the hypothesis that the illuminating power of coal-gas is really due to the presence of the small amount of olefiant gas, and other condensible hydrocarbons, separable with it by chlorine, chloride of antimony, &c., and existing in the gas only to the extent of 6 to 9 per cent., I mixed considerable quantities of gas with chlorine, allowed them to stand together

for some time, and then washed out the chlorine by an alkaline solution. On igniting the residual gas at a common burner, it burned with a very feeble yellow flame, giving out very little light. I also allowed the gas to stream through chloride of antimony into a receiver, with the same result. The chlorine and chloride of antimony absorbed and removed the 9 per cent. illuminating gases. It was evident, then, that the illuminating power of the gas was really due to the small quantity of these substances present in it, and their preservation and possible increase became a subject of great interest and importance.

I next prepared a quantity of pure olefiant gas by the action of sulphuric acid on alcohol, and burned a considerable quantity from the same burner as the coal-gas was generally burned from; and, though the light was certainly very brilliant, yet it apparently by no means so far exceeded that of the coal-gas as its composition would have led me to suppose.

It was evident, then, that the illuminating power of coal-gas was partly, if not mainly, due to hydrocarbons existing along with olefiant gas of higher illuminating power than itself, and in which the carbon and hydrogen were in a much greater state of condensation than in olefiant gas, a given volume holding much more of these elements in chemical combination than existed in any known gas. This I next proved by combustion of these light-giving gases with oxygen, when it was found that each volume of the gases required five volumes of oxygen for combustion, whilst olefiant gas required only three volumes.

There is no subject connected with gas manufacture that had been the subject of so many conjectural improvements and of so many patents as that of the removal of ammonia from gas. Most common and cheap acids, every earthly and metallic salt, almost, cheaply attainable, had been proposed and patented for this purpose, with the general notion that the ammonia existed in the gas in a free state. The patent that received the most attention, and was perhaps the most extensively employed at the time of my experiments, was Croll's. Mr. Croll passed the gas through successive portions of sulphuric acid till the ammonia was separated. I recollect that in Mr. Wroe's time, this process was strongly urged on the gas committee by the patentee, and a sum of £800 per annum was demanded for a license to use it. I submitted this process to trial, and found, as a matter of course, that though the ammonia was separated, yet that so large a portion of the illuminating gases was also removed from the gas as would by the diminution of its lighting power have rendered it a most costly process.

I tried in the same way muriatic acid, solutions of muriate of iron, of sulphate of iron, sulphate of zinc, alum, and of various other salts. All these, when supplied by the producers in solution, were found to contain much free acid, and materially to affect the illuminating power of the gas. When dry copperas was proposed for taking up the ammonia that had been carried forward from the washers, there seemed to be so little free acid, or it existed in so small amount on the surface of the crystals, as to have apparently little action on the gas, the ammonia perhaps neutralizing it as fast as presented. I have, at various times, advised Mr. Buckley, who prepares the copperas we use now, to produce it as neutral as possible, so as to prevent injury to the gas.

I append a few analyses of the gas made at Manchester before and after the alterations effected:

| | |
|---|---|
| JULY, 1844. | |
| *Olefiant gas and condensible hydrocarbons.* | 7.05 per cent. |
| Light carburetted hydrogen | 26.18 " |
| Hydrogen | 47.00 " |
| Carbonic oxide | 10.67 " |
| Nitrogen | 6.34 " |
| Oxygen | 0.63 " |
| Carbonic acid and aqueous vapor | 2.13 " |
| | 100.00 " |
| JULY, 1844. | |
| *Olefiant gas and condensible hydrocarbons.* | 6.21 per cent. |
| Light carburetted hydrogen | 36.22 " |
| Hydrogen | 48.38 " |
| Carbonic oxide | 11.17 " |
| Nitrogen | 1.77 " |
| Oxygen | trace |
| Carbonic acid and aqueous vapor | 1.25 " |
| | 100.00 " |
| AUGUST, 1844. | |
| *Olefiant gas and condensible hydrocarbons.* | 7.20 per cent. |
| Light carburetted hydrogen | 36.00 " |
| Hydrogen | 41.10 " |
| Carbonic oxide | 11.10 " |
| Nitrogen | 2.17 " |
| Oxygen | 0.14 per cent. |
| Carbonic acid and aqueous vapor | 2.27 " |
| | 99.98 " |
| 1852. | |
| *Olefiant gas and condensible hydrocarbons.* | 8.08 per cent. |
| Light carburetted hydrogen | 39.82 " |
| Hydrogen | 37.86 " |
| Carbonic oxide | 12.18 " |
| Nitrogen | 1.65 " |
| Oxygen | 0.41 " |
| | 100.00 " |
| 1853. | |
| *Olefiant gas and condensible hydrocarbons.* | 9.00 per cent. |
| Light carburetted hydrogen | 41.60 " |
| Hydrogen | 38.80 " |
| Carbonic oxide | 10.10 " |
| Nitrogen | 0.40 " |
| Oxygen | 0.10 " |
| | 100.00 " |
| 1854. | |
| *Olefiant gas and condensible hydrocarbons.* | 8.51 " |
| Light carburetted hydrogen | 38.40 " |
| Hydrogen | 37.84 " |
| Carbonic oxide | 6.10 " |
| Nitrogen | 6.38 " |
| Oxygen | 0.46 " |
| Carbonic acid and aqueous vapor | 2.32 " |
| | 100.01 " |

*Another Analysis in* 1854. *Gas Dry, and Freed from Carbonic Acid.*

| | |
|---|---|
| *Olefiant gas and condensible hydrocarbons.* | 9.21 per cent. |
| Light carburetted hydrogen | 38.08 " |
| Hydrogen | 42.33 " |
| Carbonic oxide | 4.84 " |
| Nitrogen | 5.37 " |
| Oxygen | 0.16 " |
| | 99.99 " |

In a report to the chairman of the Manchester Gas Committee, bearing date March 8, 1843, p. 9, I find, in allusion to my experiments on the ammonia contained in the gas, and the means of separation by gas-water, the following words: "I find that the only impurities left in the gas, after purification by dry lime, are *ammonia* and sulphuret of carbon. The *ammonia* I have a plan for separating, which will be *costless*, and the lime used for purifying I have so often analyzed as to be well satisfied of its mode of operation in the purification; and I am convinced I shall ultimately succeed in saving one-half the expenses in the use of this article."

At this time, the lime had to take up and remove from the gas not only the sulphuretted hydrogen, carbonic and prussic acids existing in *excess of the ammonia* in the gas, but also those portions which were in combination with the ammonia, and forming salts of that alkali. The lime decomposed these salts, seizing the acids, and liberating free ammonia to pass on with the gas to the holder. No method could be effectual and relieve the lime but one, that would take up, not the ammonia alone, but the *salts* of ammonia, before the gas reached the lime; and no method could accomplish this that would be *costless* and without injury to the gas, as I had proved, but the washing of the gas with gas-water or ammonia-water.

In a very copious report, presented to the Gas Committee in 1848, and addressed to the chairman, it is stated in page 2, that: "I have at various times reported on the manufactures incidental to that of coal-gas * * * and have also sent in at intervals brief reports of the results of particular courses of investigation relative to the gas itself." This report, which gives a *resumé* of what had been accomplished at the gas-works during the few preceding years, and gives a general detail of my researches up to that period in the incidental manufactures, improvements in gas analysis, examination of modes of testing the gas then in use, investigations on the removal of impurities from the gas, analyses and experiments showing on what the illumination depends, comparative examination and analyses of the gas made in Manchester with that produced in other large towns, accompany this paper, along with other documents. At page 43 of this report of 1848, it is stated that the substances removable by a condenser, "are held by the gas in a state of mere mechanical suspension, and are retained in it to some extent by the mere velocity of its motion; they are of a very adhesive nature, clinging to any solid surface that they may come into contact with. It is evident, then, that if the gas be allowed to rush unimpeded through the condenser, much of the tarry and ammoniacal matter is carried along with it, to be deposited during, and to impede other stages of, the process of purification. If the gas were compelled to pass through a quantity of easily-permeable solid matter exposing a large surface, the removal of the mechanical impurities of the gas would be much facilitated."

At pages 44 and 45 of the same report: "I would recommend for the works at No. 5 station not less than *sixteen washers*; the first twelve of which should be supplied with the *ammonia-water* (gas-water) prepared always in gas-making, and the last four with pure water. The great advantage of employing gas-water in the early part of the process is this, that whilst it serves to wash out and condense a large part of the ammonia from the gas, it is already nearly saturated with the gas itself, so that a large quantity may be used without much injury to the latter. Moreover, it greatly saves evaporation in the subsequent manufacture of it into salammoniac or sulphate of ammonia. On issuing from the washers, the gas passes into the dry-lime purifiers, where the sulphuretted hydrogen is entirely removed, together with most of the other impurities."

In 1850, I visited, in company with Mr. Cleminshaw, at the request of the committee, the Imperial, Brick Lane, City, Phœnix, and Chartered Gas-Works, in London; the gas-works of Brighton, Portsmouth, Southampton, Bath, Bristol, Gloucester, Birmingham, Liverpool, Leeds, and those of nearly every considerable town in England, and afterwards those of Scotland.

In not one of these places was anything in the shape of a washer, properly so called, and such as I had recommended, used. In not one place in England or Scotland was ammonia-water used as the washing material. As a general rule, the gas was led from the retorts into a vessel filled with *dry* coke, called a *scrubber*, for the removal of tar, the tar adhering to the spicular of the coke. Referring to my own notes, I find: "Imperial Gas-Works, London—filter through coke, wash by dip vessels under 26 inches pressure, use water." "Chartered—filter through coke, wash by passing gas through horizontal tubes in which water is injected." "City—don't filter, wash by dip, and surface under 24 inches." We found this system universal, where any attempt at washing was made at all.

In a preceding page, I enumerated the ordinary constituents of coal-gas, and pointed out to which of these the illuminating power of the gas was due, and in what mode that had been established. At a time when the photometer in its present form had not been invented, and the nearest approximation to the estimate of the relative light-giving power of any sample of gas or gases was obtained by observing the intensity of the shadow which it cast, it became an object of the highest importance to discover a method of analysis of the gas, or some examination of it, which should give an expression of its illuminating powers I subjected to careful examination the various processes in use; the shadow test, or photometer; the test of weight, or relative specific gravity; Dr. Fyfe's method by chlorine; Dr. Henry's chlorine test; and the method of combustion with oxygen, and determining the number of volumes required by 100 volumes of the gas. After many hundreds of analyses of the gas by these several methods, the fallacies attending which I reported upon to the committee in 1848, and which I need not go through in this report, inasmuch as they are published in the transactions of the Literary and Philosophical Society of Manchester in 1851, in a paper which I append, I devised a method of analysis by combustion, or explosion of the original gas with oxygen in tubes over mercury, ascertaining the number of volumes of oxygen required for the combustion of 100 volumes of the gas, the number of volumes of carbonic acid produced, and the condensation of volume consequent on the process. Then, by abstracting the condensible gases (the olefiant, &c.), by fuming sulphuric acid or by chloride of antimony, I ascertained the volumes of these; and, by exploding the residual gas again with oxygen and noting the volumes required, and of carbonic acid produced and the condensation, I got a numerical expression within a narrow range of the illuminating power, since I obtained for each volume of the condensible illuminating gases the number of volumes of oxygen required to burn it; the number of atoms of carbon, or the percentage of carbon, in each volume expressed by the carbonic acid produced; and the state of condensation in which it existed in the gas. The sum of the volumes of oxygen

required into that of the carbonic acid produced, was the expression of the illuminating power less that of the light carburetted hydrogen, the coefficient of whose illuminating power was unknown, but which I am now engaged in the investigation of. This method I reported also to the committee in 1848, and it is contained in the essay appended. It was of vital importance to obtain a correct method of analysis, in order to test the effect of whatever was done in the manufacture and purification of the gas, and to determine the relative value of the gas-producing materials, coal and cannel, and, in some respects, the excellence of management. The drawback to this method of analysis was in the great care and labor required to ensure exactness, and the interminable calculations involved. Nevertheless, I was constantly engaged in them over a period of many years, and I am of opinion that it is even yet the most exact method of determining the illuminating power of a gas, as it is based on well-known and accurately-determined constants.

As a means of determining the effect of the different modes of purification that might be tried and adopted, as well as to keep a constant check on the care taken in the manufacture of the gas, it became necessary to devise a means by which the exact amount of any impurity in the gas might be ascertained in a sufficient volume of it, so that in effect we could measure the action of any purifying agent. The ordinary method still in use everywhere, except in Manchester, was to expose slips of paper soaked in different reagents to the action of the gas. This simply indicated the presence, or otherwise, of one or two impurities in the gas, without reference to quantity, and was useless for my purpose. I wanted to analyze 1,000 feet of gas for impurities, if necessary. I, therefore, devised certain test-solutions—one a muriatic solution, which would absorb the salts of ammonia or free ammonia, if present; this was introduced into a series of large bulb-tubes, and the gas streamed through it in a gentle current night and day continuously; when a sufficiency of gas had passed through, the gas being measured by a meter, the solution was precipitated by a salt of platinum, and the ammonia estimated with absolute certainty. The other was a potash solution of arsenic, which has the property of absorbing sulphuretted hydrogen perfectly, and, on neutralization and acidification, of precipitating it in the form of orpiment. This was introduced into similar bulb-tubes, and afforded the means of estimating the amount of sulphuretted hydrogen in the gas with the most perfect accuracy. On the purity of the gas, as determined by these methods, I have been in the habit of reporting to the committee constantly. I also, by similar apparatus, tested for prussic acid and arsenic.

In an earlier part of this report, I have enumerated sulphuret of carbon amongst the impurities of coal-gas; for, though until the period of my experiments its actual existence in gas was rather inferred than actually known, yet from the mode of production of the gas, and the certainty that coal and cannel always contain sulphur in the form of iron pyrites, or of sulphate, which, when heated to incandescence, would decompose, giving off their sulphur to the carbon, chemists did not doubt that the vapor of sulphuret of carbon would be one of the impurities of coal-gas. I am not aware, however, that any attempt was made to confirm this belief by an exact scientific process till my own experiments were made in 1855–56. In consequence of the destruction of the bindings of the books in the Portico Library, which was prominently brought before the public, I instituted some inquiries which left no doubt on my mind that the injury was due to sulphuric acid, formed from the combustion of sulphuret of carbon in the gas burned in the library. To test the matter absolutely, however, I fitted up at No. 2 station, in 1855, a small purifier, having four shelves, two being covered with a mixture of caustic soda, and lime, and two with moist carbonate of lead. Through this I conducted a measured quantity of gas, which in its passage must necessarily lose every trace of sulphuretted hydrogen. I then burned the gas in a bell-jar, dipping into a glass dish, having a layer of about two inches of a solution of pure potass. The flame was fed by air drawn through the bell-jar by large aspirators made of oil butts filled with water. Between the aspirator and the bell-jar were interposed glass bulb-tubes filled with a solution of pure potass, through which all the air from the bell-jar had to pass on its way to the aspirator. Any acid results of the combustion must necessarily be caught by the solution of potass in the glass dish and in the bulb-tubes. I burned the gas by a very small flame continuously for nearly six weeks, measuring the gas by a meter, and then oxidized the potass solution by hot fuming nitric acid. On precipitating by a salt of barytes, I obtained a quantity of sulphate of barytes, from which the quantity of sulphuret of carbon per 1,000 feet of gas could be calculated. The amount of sulphuret of carbon indicated by these experiments I found, as might be expected from the different coals and cannels used (for I continued the experiments over three of four years), to vary considerably. The greatest quantity of sulphuret of carbon I obtained was 109.8 grains from 100 feet, and the smallest 13 grains.

Though there could be no doubt, from the absence of sulphuretted hydrogen in the gas, that the sulphuric acid must proceed from sulphuret of carbon; yet, to place the matter beyond question, I interposed, in another experiment, between the purifier and the bell-jar, two bulb-tubes containing solution of proto-sulphide of potassium, and I obtained, after a time, crystals of sulpho-carbonate of potass, which could only proceed from sulphuret of carbon and sulphuret of potassium. Having thus absolutely demonstrated the existence of sulphuret of carbon in gas, and ascertained its quantity to be considerable, it occurred to me that, as sulphide of potassium unites with it so readily, sulphide of ammonium would probably exert a similar reaction. I therefore prepared a solution of sulphide of ammonium, and found that, on adding to it sulphuret of carbon, an immediate reaction ensued, sulphuret of carbon being decomposed, and sulpho-carbonate of ammonia formed a salt very soluble in water. This experiment I exhibited before the committee. To remove the carbonic acid from gas-water by lime, and to pass the unpurified gas through it, so as still further to saturate the ammonia-water with sulphuretted hydrogen, was a simple step; and this being done, it was found that the gas-water so saturated was able to combine with the bulk of the sulphuret of carbon, and wonderfully to sweeten the gas. The great extent to which the gas is sweetened by the process of washing with causticised gas-water, leads me to the belief that it must also combine with, and remove from the gas some very offensive oils. I trust that very shortly thus impurity of the gas will be numbered with the things that are passed.

In 1860, I analyzed all the cannels used at the two stations, and determined, by numerous and careful experiments, the percentage of sulphur in each. I calculated the sulphur in the total quantity of cannels used, and the relation it bore to the lime used in purification at each station, from June 25, 1858, to May 31, 1860, and reported to the committee. I also determined the amount of sulphur in the unpurified gas at each station.

Whilst following out my own researches on gas, the materials, circumstances, and concomitants of its production, I trust I have not been unmindful of the interests of the committee, in carefully examining and practically testing such plans as have from time to time been pressed on the committee for adoption, and may, perhaps, claim to have assisted materially in saving large unnecessary outlay on schemes of proved inutility, or founded on false conceptions. Amongst the rest, it will scarcely be necessary to allude to the so called hydrocarbon process of gas-making, which was very pertinaceously pressed on the committee, and the fallacies of which I exposed in ample reports, and confirmed by numerous analyses. Those analyses and reports are amongst the papers accompanying this statement.

During last summer it occurred to me to examine chemically the copperas supplied to the works, after its use in purification, with a view to ascertain the amount of sulphate of ammonia it might contain. I dissolved out from the mass all the soluble salts evaporated to a concentrated liquor, mixed this in a retort with caustic potass, and distilled off the ammonia into an acid, and estimated its amount. The result was, that I sent for Mr. Holroyd, and told him that he must pay three times the amount he had hitherto done for the charged copperas, to which, after some demur, he agreed; and the committee is the gainer by a sum, I presume (for I have not the figures before me), of about £200 per annum.

## PAPERS ON HYDRAULIC ENGINEERING.

BY SAMUEL M'ELROY, C. E.

### *No. 3.—Pumping Engines.*

[From the Journal of the Franklin Institute.]

(*Continued from page* 12.)

*High Steam.*—It is well understood in the world of practical engineering, and is confirmed by correct theory, that it is much cheaper to make high steam than low steam, from the saving in fuel to produce equivalent power, the improved condition of heat convection in the boiler contents, the comparative losses by external radiation, and the resultant increase by superheating. The favorite method of "making up time," among first-class locomotive engineers, by running up the steam-gauge at the stations, and shortening the cut-off notch, illustrates forcibly the correctness of this source of economic increase of power, applicable to all kinds of boilers. It is a matter of demonstration that 90.7 pounds of coal, making steam at 60 pounds, are worth 100 for steam at 15 pounds, or about atmospheric pressure, and that in each of the other sources of advantage named, the issue is decidedly favorable to the higher pressures. It is also true, that up to a certain range of heating (550°), iron boiler-plates increase their strength, while below a certain tension, which is far within the limits of ultimate strain, a boiler is as safe from one pressure as another, in reference to the usual sources of danger from disruption and explosion, which rest so much on careful attendance. As to safety under working strain, we believe that there is little to be feared from steady pressure, even at ranges which may be called excessive, and have slept over 180 and 200 pounds of steam, after some study of the attention of the firemen to the gauge-cocks, confident of as great safety as over one-fifth or one-tenth the gauge. We do not, of course, advocate such a pressure for pumping engine-boilers, but even in cases where a close-throttle must be adopted, we certainly do advise something like the Cornish standard of pressure, from 45 to 60 pounds. The effect in duty, demonstrated by numerous trials on the Brooklyn boilers, of an increase from 9 to 18 pounds pressure, was too emphatic to leave any room for question, even as to so unreasonably low gauges.

*Superheating.*—Some positive means of giving all boiler steam the benefit of this process, should be adopted. Among all the extravagant claims of enthusiasts on this subject, which have induced a general re-action, too much has been proved as to its benefits to be lightly disregarded, up to a certain moderate range of application; and by this we mean an application more distinct and more clearly defined than the ordinary process of superheating common to boilers with chimney uptakes or steam domes. If saturated steam, by the addition of from 7 to 75 degrees of heat, will be expanded from 10 to 30 per cent., as some experiments have it, and such increment of heat can be conveniently taken from the wasted gases of combustion, there is great propriety in the application; and granting the special claim to be erroneous as to gain, if the steam can be fortified against the steam-pipe, chest, and cylinder radiations and condensations, so as to show the boiler pressure on the indicator-cards, even this result is worth the slight cost of attaining it. In most of our engines, the losses between the cylinder and boilers are formidable in their percentage of coal waste.

*Improved Conduction.*—It is urged by some authorities, and endorsed by experiment, that the use in boiler-flues of conducting-pins about 3 ins. long, projecting downward, into the heated currents, by presenting much more favorable points of heat transmission than the smooth surface of the flue-sheets, improves the evaporation. The application is simple and is justified by the conditions of furnace-flue action.

*Summary.*—The general lesson taught by the diversified forms and operations of boilers, and the principles of their action, is, that the great majority come far short of available natural results, from imperfect design and management, and that the simpler forms are practically and theoretically to be preferred.

In the table on page 11, and which is taken from

various sources, rather as a general illustration of such results than as collated evidences of any special theories, will be found with some study, a running comment on relative rates of combustion, relative grate and heating surface, relative efficiency of tubes and flues, and general proportions.

Its principal use, however, or the use of such a table as we should like to present, if present pressure of other occupations did not prevent, is to show the need of a more systematic investigation of a subject which is vital to all the mechanical operations of the day, and the general adoption of such rules of design and manipulation as shall improve the present wasteful experience. A single thought of the immense sums of money spent in fuel annually in our land, and the effect of even a moderate percentage of improvement, brings the necessity of some organized and effective movement in this direction forcibly to view.

Of this particular tabulation, however, it cannot be claimed that its special experiments have the force of absolute demonstration, since each is based on special and local conditions as to quality of fuel, manner of firing, correctness of coal account, rate of combustion, and other modifications which prevent a rigid deduction of any rule of proportion.

The most complete group of experiments on the *Michigan*, made under the special charge of one of the most accomplished engineers of the day, and on boilers which are presented as perfections of multi-tubular model, are yet anomalous in their several results, and demonstrate a fact practically known to all thoroughbred engineers, that with the same conditions of experiment results may be greatly varied by differences in manipulation. These experiments, made to determine a very different question, really became observations on relative facilities of combustion and evaporation in the same boilers.

The experiment on the *Susquehanna*, as has been shown in a paper above referred to, were too carelessly made to secure correct results. Those on the *San Jacinto*, made expressly to determine the relative merits of tubes and flues, just as expressly prove the value of results obtained under conditions of design and operation, clearly unfavorable to the latter.

While, then, a critical analysis of each experiment detailed, would modify its relations to the general aggregate, there can be no question, we think, that the aggregate itself is clear and plain on the advantages of simplicity in form, as to the desideratum of power, compactness, access, and other special requirements for boiler use, and the results obtained from the boiler of such construction are too prominent to be overlooked or denied.

There are several other points on this general subject which probably should be presented to complete the hurried sketch herein attempted, but cannot now be given from want of space and time.

*General Conclusion.*—Having made a distinct analysis of the three divisions of a pumping engine, viz.: the pumps, engine, and boilers, it remains to group the several parts together, in some discussion of joint performance.

As to the pumps of large engines, we have noticed the advantages of double-beat valves, the usual defects in suction arrangement and lift, the relative merits of plungers and buckets, the benefit of direct lines of supply and delivery, and of large openings, the fallacy of uniform motion and short strokes, the doctrine of uniformly variable motion, of loss of action of combined pumps, of force main size and line, and of air-chambers.

The single-acting engines have been noticed as to their arrangement in general and detail, their rank as standards of all other classes, their merits in comparison with double-acting engines, the defects of crank motion, the principles of high steam, expansion, momentum, and the defects of combined engines.

The boilers have been noticed as to their varieties of arrangement, furnaces, flues, and tubes, proportions, appurtenances, fuel, general management, and comparative economy.

From this subdivision of this subject, in which each part exerts an individual effect on the general result of economy, durability, and perfection of operation, the prominent lesson which is derived, is that of the benefit and necessity of simplicity in form; the highest results being evidently contingent on the most direct and facile lines and method of motion, and the least complicated design.

Careful construction in adaptation to intended work, careful workmanship, and careful management solve the problem of maximum duty, in these three divisions, jointly and severally.

*Problem of Duty.*—As the coal fed to the furnaces, in one division, and the water delivered to the reservoir in another, form the basis of calculation in engine duty, it is evident that each part must give a maximum result in order to ensure a maximum in the whole combination; and that the engine should be perfectly adjusted in itself to its work, without embarrassment from the boilers on one side, or the pumps on the other. It is also plain that a perfect combination in timid or incompetent hands cannot develop its true measure of results. Educated design is often overruled in the workshop, and seriously injured in anticipated results. If the history of most of our prominent engines was faithfully written, it would utter no unmeaning verdict against those who are "wise above what is written," and foolishly obstinate in that arrogance of opinion which too often characterizes the half educated. Equally true is it, that the best engines often come short of their real capacities through equally obstinate and prejudiced handling.

*Theoretical Duty.*—Taking the value of carbon and hydrogen in one pound of coal as equal to an evaporation of 14.25 pounds of water, and taking the steam at atmospheric pressure, we have the following duty in the boiler:

14.7 pounds per square inch x 1700 (relative volume) x 144 square inches x 14.25 pounds of water evaporated ÷ 61.13 pounds of water per cubic foot at 212° = 838,819 pounds raised one foot per pound of coal.

At one-third cut-off this duty, multiplied by 2.099 = 1,706,681 foot-pounds, and at one-tenth cut-off, for the ratio of 3.3 = 2,768,102 foot-pounds, and these amounts vary with various ratios of expansion. They will be also increased by a higher range of boiler pressure, in some degree.

*(To be continued.)*

## IMPORTANCE OF A PURE WATER SUPPLY.

Dr. Nichols has communicated to the Boston *Medical and Surgical Journal*, some very interesting remarks on *obscure sources of disease*, from which we make the following extracts respecting the importance of a supply of water entirely uncontaminated by organic or inorganic impurities:

"There are many instances of disease, brought to the notice of physicians, which are exceedingly perplexing in their character, and the sources of which are very imperfectly understood. I am led to believe that a considerable number arise from some disturbance in the sanitary conditions of dwellings or their surroundings, and that however improbable this may seem from a superficial or even careful examination of suspected premises, a still more thorough and extended search will often result in the discovery of some agent or agents capable of producing disease.

"The chemical and physical condition of water used for culinary purposes has much to do with health, and is perhaps the oftenest overlooked by the physician in searching for the cause of sickness. We must not suppose that water is only hurtful when impregnated with the salts of lead or other metals; there are different sources of contamination, which produce the most serious disturbance upon the system. Some of these are very obscure and difficult of detection. The senses of taste and smell are not to be relied upon in examinations, as it often happens that water entirely unfit for use is devoid of all physical appearances calculated to awaken suspicion. It is clear, inodorous, palatable, and there is no apparent source from whence impurity may arise.

"During the past summer, the writer was consulted by a gentleman residing in Roxbury, respecting the water used in his family. It was taken into the dwelling through tin-pipe from a well in the immediate vicinity, and appeared to be perfectly pure and healthful. Analysis disclosed no salt of lead or copper, as indeed none could be expected from the unusual precautions taken to prevent contact of the water with these metals. Abundant evidence was, however, afforded that, through some avenue, organic matters in unusual quantities were finding access to the water. Careful examination of the premises disclosed the fact that an outhouse on the grounds of a neighbor was so situated as to act as a receptacle for house drainings, and from thence by subterranean passages the liquids flowed into the well. Some cases of illness, of long standing in the family, disappeared upon abandoning the use of the water.

"A few months since a specimen of water was brought to me for chemical examination, by a gentleman of Charleston, who stated that his wife was afflicted with protracted illness of a somewhat unusual character. It was found to be largely impregnated with potash and the salts resulting from the decomposition of animal and vegetable *debris;* and the opinion was expressed that a connection existed between the well and the waste fluids of the dwelling. This seemed improbable, as they were all securely carried away in a brick-cemented drain, and in a direction opposite the water-supply. The use of the spade, however, revealed a break in the drain at a point favorable for an inflowing into the well, and hence the source of the contamination. Rapid convalescence followed on the part of the sick wife upon obtaining water from another source.

"Analysis was recently made of water from a well in Middlesex county, which disclosed conditions quite similar to these. The owner was certain that no impurity could arise from sources suggested, but rigid and persistent investigation disclosed the fact that the servant girl had long been in the habit of emptying the "slops" into a cavity by the kitchen door (formed by the displacement of several bricks in the pavement, where they were readily absorbed. Although the well was quite remote, the intervening space was filled with coarse sand and rubble stones, and hence the unclean liquids found an easy passage to the water. This proved to be the cause of illness in the family.

"In cities and large towns, where excrementious matters accumulate rapidly around dwellings compacted together, it is difficult to locate wells remote from danger, and hence it might seem that suspicion should be confined to those localities. This, however, is not a safe conclusion. How often do we see, upon isolated farms in the country, the well-located within or upon the margin of the barn-yard, near huge manure heaps, reeking with ammonical and other gases, the prolific sources of soluble salts, which find access to the water and render it unfit as a beverage for man and beast. It may no doubt be a convenience to the farmer to have his water-supply so situated as to meet the wants of the occupants of his barn and dwelling, but it is full of danger.

"Whilst admitting that such may be the condition of the water of many wells, doubts may arise with some, whether substances not decidedly poisonous, and received in such quantities, can, after all, be productive of much harm, or the real sources of illness. To the great majority of people they are certainly harmless, but it must be admitted that there is a class, and one or more are found in almost every family, whose peculiarly sensitive organization does not admit of the presence of any extraneous agent in food or drink, or in what they inhale. The functions of life and health are disturbed by the slightest deviation from the usual or normal condition of things around them.

"It seems incredible that the thousandth part of a grain of one of the salts of lead, dissolved in water and taken daily, will disturb the system of any one; and yet such is the case. We can see no reason why a very little nitrate of potassa, or soda, or lime, taken in the same way, should produce any effects; still stranger is it that the infinitesimal amount of dust dislodged from painted wall-papers, received into the lungs, should make inroads upon health."

LARGE WATER-METER.—The Manchester, England, Water-Meter Company, have recently completed a water-meter for the Manchester water works, which is capable of measuring one million gallons per day. This is the largest meter on the piston and cylinder principle ever constructed. It has been placed at Denton, where it is to be used in measuring water for the town of Stockport.

## PETROLEUM ITEMS.

Petroleum in Burmah.—Although the greatest reservoirs of petroleum exist in North America—the fields most profitably worked at present being in Pennsylvania and Canada—yet it is widely diffused in all quarters of the globe. A Philadelphia paper thus refers to the existence of petroleum in Burmah:

"No fewer than eighty petroleum wells of great productiveness have recently been discovered near the capital of Burmah It seems probable that this discovery will make the Irriwaddy as famous as those of the Allegheny, where our oil wells began a few years since to attract attention. Indeed, a few wells of the crude oil have long been known to exist on the banks of this river, but as there was no knowledge of the process of refining it, the value of the oil has been but little regarded. As our discovery of gold in California stimulated zeal and observation, and led to the discovery of the same metal in Australia, and in the British American possessions on the Pacific, so the success of our petroleum wells has no doubt led to the following up of investigations even in Burmah, to this important point.

There are many reasons, it seems to us, why Americans should follow up this discovery, and get the working of some at least of these wells, and the refining of the oils. The wells, so far discovered, all lie not on British soil, but in the territory which yet remains to the government. There the preference for Americans is very marked, so far as it can be shown.

But, besides this, Americans understand better than any others the art of working these new mines of wealth. They have the benefit of experience. They "suck honey out of the rock, and oil out of the flinty rock." We could show the best process of refining it, and the whole of these works might be engaged in by careful and prudent capitalists in such a manner as to produce vast returns, employ a great number of the natives, extending our commerce and influence in Burmah. There is no other such supply known for India, and the demand for oil for all kinds of steam works is and must be very great, besides that used for lighting houses.

It is a very great and common mistake to suppose that petroleum has never been known until within a few years. It has been used in Burmah for many years, probably many ages, and used for some few purposes. It was known among the ancients, and is expressly mentioned by Herodotus. It is probably alluded to by Moses, Deut. 32, 13. Nor is it at all unlikely that somewhere in the neighborhood of the Dead Sea a useful supply of it may be found. The bitumen found in that region is in fact the same substance in a solid form.

That which has been done in modern times, has been to develope the production of it in such quantities as to make it truly valuable for the purposes of political economy, more than supplying the failing oil derived from the whale fisheries. It has also been our work to refine it and render it useful for a thousand purposes to which it could not be applied before. No doubt the manufacture of the English and American paraffine oil by distillation from the coal led to those arts by which the purifying process was already known when the large supply of crude oil was discovered. But it is a curious and instructive fact, that a substance like this, known to exist for almost two thousand five hundred years, should, within the last ten years, be rendered useful to the world by the citizens of Pennsylvania, and having been thus subsidized, is now being sought and found in some of the oldest settled portions of the globe."

## GAS IN ENGLAND.

The Independent Gas Company of London have reduced the price of their gas from 4*s.* 6*d.* to 4*s.* per thousand cubic feet. This resolution was made on the 15th of May last. We venture to say that the company will not lose by their liberality.

On the 20th of May last, the district of Windermere, comprising Bowness and Birthwaite, was lighted with gas for the first time. The works were erected by Mr. J. T. Hall, the gas-engineer of the London and Northwestern Railway Company. In constructing these works, it was found necessary to excavate the tank for the holder out of rock, and to lay the mains in rock, both of which have been successfully executed. The works have given great satisfaction to all parties interested.

The Ipswich Gas Company have reduced the price of their gas from 4*s.* 6*d.* to 4*s.* per thousand cubic feet.

New gas-works are about being erected at Minston, for the supply of Sittingbourne. They will include a coal-shed large enough to hold 1,000. The main, an 8-inch one, is more than half laid.

At Godulming, the consumers are very much dissatisfied with the price of gas, which is at the rate of 7*s.* 6*d.* per thousand cubic feet. Steps have been taken to bring the matter before the directors of the company, and, as an *ultima ratio*, to threaten an opposition company which a gentleman proposes to undertake, and to furnish gas at from 4*s.* to 5*s.* per thousand.

At Reading eight hundred £10 shares of the gas company have been recently sold at auction and realized £10 5*s.* to £10 10*s.* per share. The new purchasers are promised 7 per cent.

The Burslem and Tunstall Gas Company have declared their usual dividends of ten and seven per cent., old and new shares, free of the income-tax.

## CESSPOOLS AND TYPHOID FEVER.

The London *Builder*, an excellent authority in sanitary matters, says that the local commissioners of Galashiels have consulted Dr. Brisbane as to the connection of town cesspools with fever, and the consequent desirability of getting rid of the cesspools. The report of the doctor says, that for some years past the facts as to typhoid fever prove the connection of such fevers with cesspools. He further says: "That outbreaks of typhoid, enteric, or gastric fever, are essentially connected with defective drainage is now an almost universally acknowledged fact. Whether the fever poison is generated *de novo* by decomposing sewage, or merely fostered thereby, may admit of some doubt; but no doubt whatever exists as to the intimate relation between outbreaks of gastric fever and the emanations from sewage or other putrescent substances. The continued fevers met with in this country have been divided into four classes by Dr. Murchison: 1, *Febricula*, due to errors in diet, heat, fatigue, &c.; 2, *Relapsing fever*, due to famine; 3, *Typhus fever*, due to over-crowding and destitution; 4, *Typhoid fever*, or *gastric fever*, due to causes above stated. It is notorious that *relapsing* fever is never met with in Galashiels, and *typhus* rarely, the species of fever almost always met with being febricula, or gastric. Again, it is sufficiently established that the latter fever generally prevails most in autumn, particularly during dry, warm seasons, the high temperature favoring decomposition, while the defect of water prevents the efficient removal of the putrid substances thus generated. The causes of any disease being known, and these being remediable, it behooves our sanitary authorities to direct every legitimate and available means towards the eradication of these." Dr. Brisbane also states that he believes the above cause is an equally fertile source of other and more formidable diseases, such as diptheria, cholera, &c. The quality of the water has also much to do with the health of a community.

Chemical Constitution of American Rock Oil.—Schorlemmer has examined the oils obtained by the distillation of cannel coal at low temperatures, the mixture of which is known in the United States as kerosene. The oil in question is found to contain a series of homologous hydrocarbons of the general formula Cn Hn + 2, and consisting of the hydurets of the alcohol radicals. The oil which boils below 120° C., contains the four hydurets:

| | | | |
|---|---|---|---|
| $C_{10}$ $H_{12}$, | hyduret of | amyl, boiling at | 39° C., |
| $C_{12}$ $H_{14}$, | " | hexyl, " | 68° C., |
| $C_{14}$ $H_{16}$, | " | heptyl, " | 98° C., |
| $C_{16}$ $H_{18}$, | " | octyl, " | 119° C. |

The author found precisely the same products in the American petroleum or rock oil. The oils are first purified by strong nitric acid, which leaves the greater part unattacked, but removes benzole and toluole. After washing, drying over caustic potash, and distillation with soduim, the four hydurets already mentioned were obtained as in coal-tar. Benzole and toluole are found in larger proportion in cannel coal-tar than in petroleum.—*Silliman's Journal.*

New Mode of Lighting Churches.—A novel mode of lighting has been introduced at a Baptist church, just built at Philadelphia. There is not a gas-burner in the audience-room. In the panels of the ceiling are circles of ground glass, two feet in diameter. Above each of these, in the loft, is an argand burner, and over the burner a powerful reflector. The effect is just about the same as if there were thirty full moons shining in the ceiling. The light is not sharp and intense, but abundant and mellow, and not painful to the eyes.

The Electric Light in England.—The London *Builder* says that, in a report on the electric light, printed by order of the House of Commons, the Secretary says:

"The light has now been exhibited at Dungeness for a period of nine months; and during that time has, with some brief exceptions (generally attributable to want of care on the part of the attendants), been maintained without break or failure, showing a light of exceeding power and intensity, which Mr. Faraday, who took as his standard the revolving light at Grisney, with which, at equal distances it was of equal power, estimated to be eight times that of a first order fixed dioptric light. Every part of the machines and engines has worked well, although one of the boilers has just required repair, causing a pressing demand from the engineer for the third spare boiler, which he suggested as necessary. The lamps and lenses have been gradually improved, until they may now be said to be perfectly satisfactory, and have been under the charge of the ordinary light keepers, possessing no more than the usual ability of such persons. The engines and machines have been under the charge of two engineers."

The *Builder* goes on to say that various minor objections to the light, as it exists, are stated in some of the reports; but some of these are vitiated by the discovery that the chief engineer has been recently dismissed on a charge of intoxication. The light is visible at a distance of thirty miles, but occasionally, not so far—a circumstance which Prof. Faraday attributes to local haze. The Trinity House authorities, however, admit the superior advantages of the light in respect to penetrative power and star-like brilliancy, although other first class lights they regard as practically sufficient.

Utilization of the Sulphur in Coal-Gas.—Our readers are generally aware that Mr. F. C. Hills, of England, patented a process for purifying gas from sulphur compounds by means of hydrated per-oxide of iron, which effects the removal of these noxious ingredients with great certainty. After the oxide of iron has become surcharged with sulphur, it is exposed to the air, by which it is oxidized—hydrated peroxide of iron being again formed and the sulphur separated. According to Dr. Hoffman, after this operation has been repeated several times, the sulphur amounts to 40 per cent., and the material is then unfit for the purification of gas, but is used for producing sulphurous acid, for the manufacture of oil of vitriol, by wasting in reverbratory furnaces. In 1859 one factory used 737 tons of this material, and in 1861 the same establishment used no less than 2,180 tons. Dr. Hoffman says this material yields one and a fourth of its weight of oil of vitrol.

Quality of Gas in Paris.—M. Michal, the chief director of the municipal and public works in Paris, states that the average illuminating power of the gas supplied by the Paris Gas Company, during the year 1862, has been such that 24.8 litres, or 8,757 cubic feet, gave the same light as ten grammes, or 154,345 grains of colza oil, when burned in a Carcel lamp, giving the light of seven standard sperm candles.

Water-Works of Hay, England.—The water-works of Hay have been recently completed, and the inhabitants of the place are enjoying the advantages of a full and abundant supply. The reservoir, which is 175 by 54 feet, and 11 feet in depth, is supplied by a mountain stream some half a mile distant, which is diverted, and then passed through a filter six feet in depth, composed of granite and sand, before entering the reservoir, where it is joined by two springs, obtained by boring about thirty feet to the rock (old red sandstone formation.) Previously to these supplies entering the mains from reservoirs, they have to pass through another filter bed, on the ascension principle, formed of slabs, with a pressure of twelve feet. The supply is thus filtered by ascent and descent.

Carlisle, Pa.—Among other acts of vandalism committed by the rebels when occupying the town of Carlisle, Pa, was that of burning the gas-works, which they entirely destroyed.

## PATENTS.

UNITED STATES.

38,811.—Nathaniel Colver, Chicago, Ill., for an Apparatus for Raising Water:

I claim the arrangement of the screw, h h, within a conduit, c2 d2, whose inlet is placed in a plane lower than that of its exit passage, when applied for the purpose of displacing and drawing off stagnant and sluggish waters and causing an artificial inflow of pure water, substantially in the manner and for the purposes herein set forth and described.

38,822.—Alexander Hamill, Baltimore, Md., for a Composition for Lubricating:

I claim the mixture in suitable proportions of pulverized soapstone with crude petroleum, coal-oil, or any of its products, to form a lubricator for machinery.

38,823.—Hiram W. Hayden, Waterbury, Conn., for a Mode of Ornamenting Lamp Stands, &c.

I claim the method herein specified of ornamenting a lamp-stand or similar article, by interrupted parallel lines, engraved upon the surface of such article, by a tool in contact with such surface, while the said article is being rotated as specified.

38,825.—Wm. G. Hermance, West Sandlake, N. Y., for Compound Oil for Burning and Lubricating:

I claim the compound produced by the admixture of fish or other animal or vegetable oil with mineral oil substantially in the proportions herein described.

38,826.—Frederick Hewitt, Newark, N. J., for a Lamp Top:

I claim, first, The fastening together of the two specific parts of a lamp, viz., the top or fluid receptacle, by means of corresponding wedged-shaped pieces substantially as described.

Second, I claim as new the combination of the parts, A C C' B, and D D', substantially in the manner and for the purposes described, all being parts of a lamp as herein set forth.

38,841.—Joshua Regester, Baltimore, Md., for a Hydrant:

I claim, first, Combining in one and the same tube or tail stock C C' C'', the two cocks, E E', arranged and operating substantially as herein described.

Second, Making the axes of the two cocks, when combined in one tail, stock or tube, in the same plane, and conducting the water through C, and around the "street supply" cock, substantially as herein described.

Third, Combining with and supporting the street and house-supply cocks within a metallic casing, constructed substantially as herein described.

Fourth, The combination of the key rod, G, tubular key rod, F bearings, a a', and supply cocks, E E, substantially as and for the purposes set forth.

38,846.—John H. Seaman, Brooklyn, N. Y., for a Lamp:

I claim the combination of the air tubes, M N, and chamber, L, with the chamber, E, and fountain, A, substantially in the manner herein shown and described.

I also claim the combination with the above-named parts of the tube, F, valve, H, and socket, G, as shown and described.

38,850.—William B. Wadsworth, Cleveland, Ohio, for a Water Elevator:

I claim the combination of the chair and wheel, substantially as described, with the bucket, F, rod, I, valve g, and spout, A, substantially as described.

38,856.—Elias L. Yorke, Honeoye Falls, N. Y., for a Water Elevator:

I claim, first, The ratchet box, D, consisting of the disk, b, having a laterally bearing frictional surface, the cylindrical flange, d, and the ribs, e e, or equivalent: said ratchet box turning loosely on the shaft, and held by the pawl, K, substantially as herein described.

Second, In combination with the ratchet box thus arranged, I also claim the gear plate, G, having notches, g g, or equivalent, sliding over the ribs, e e, in such a manner as to hold on the shoulders, f f, when turned forward, but to be disengaged therefrom when turned back, substantially as specified.

Third, I also claim, in combination with the gear plate, provided with the concentric inclined teeth, h h, the crank gear, H, having similarly engaging teeth, n n, substantially as and for the purpose herein set forth.

Fourth, In combination with the gear plate, G, and crank gear, H, I also claim the coupling gear, I, arranged and operating substantially as herein specified.

Fifth, I also claim the combination and arrangement of the ratchet box, D, coiled spring, E, or equivalent, gear plate G, crank gear, H, coupling gear I, pawl, K, and frictional bearing shoulders, a p, whereby the whole automatic action is produced, substantially as herein set forth.

38,859.—F. B. de Kerevenan (assignor to Joseph H. Bailey and George A. Jones), New York city, for Mechanical Movement for Lamps:

I claim the general arrangement and combination of the mechanism herein described for the purpose of supplying air to the lamps, &c.

38,879.—W. B. Billings, New York city, ante-dated June 10, 1863, for a Coal-oil Lamp:

I claim, first, The impelled current of air when carried into the self-generating burner for the purpose and in the manner substantially as set forth.

Second, The mixing or mingling of the self-generated vapor with the impelled current of air in the burner, near the point of combustion.

38,881.—Henry Booth, Jr., New York city, for a Lamp Chimney:

I claim the combination of the lower glass portion, D, of the chimney, with the metal tube portion, E, when the latter has pendent rods, c c, attached to it, which are fitted in tubes, C C, connected to a ring or band, A, placed on the burner, B, and all arranged substantially as and for the purpose herein set forth.

38,887.—Daniel Doncaster, Punxutawney, Pa., for a Water Wheel:

I claim, first, The combination of a turbine, A, with a guide wheel, C, and an adjustable suspension frame, E, when arranged and operating substantially in the manner described, for the purposes set forth.

Second, The combination of the turbine, A, and adjustable gate, G, when constructed, arranged, and operated, substantially in the manner, and for the purposes set forth.

Third, The combination of an adjustable guide frame, a guide wheel, and a turbine, with a gate arranged below the same; the whole operating substantially in the manner described, and for the purposes specified.

38,926.—P. J. Clark (assignor to S. S. Clark), West Meriden, Conn., for a Lamp Burner:

I claim the two inclined wick-tubes, d d, when closed by plates, f, at their edges or narrow sides, to form a draught-space, g, and provided with elevated outer sides, 2, and inner sides, 1, on a level with the upper edges of the plate, f, and fitted at their lower ends in a box, a, into which air is admitted into the space, g, formed by the wick tubes and plates, f, the wick tubes being curved in their horizontal section, and all arranged as and for the purpose herein set forth.

38,983.—John Pomeroy (assignor to Henry A. Shipman & Robert Headly), Derby, Conn., for a Lamp Wick Regulator:

I claim the combination of one or more spur wheels, with the center pin or axis fastened together by upsetting the center pin so as to fill a polygonal hole in each spur-wheel, and form a collar on each side of it, substantially in the manner and for the purposes set forth.

38,947.—G. F. J. Colburn, Newark, N. J.—Ante-dated Oct. 5, 1862, for a Glass Chimney for Lamps:

I claim a glass lamp chimney, A, with one or more glass handles or projections, B, substantially as described.

38,960.—James B. Gray, Hudson, Wis., for a Lamp Burner:

I claim, first, The combination of the divided lamp-cap, with a vertically adjustable wick-tube, substantially as and for the purposes herein described.

Second, The hooked friction spring, d, or its equivalent, in combination with the adjustable wick-tube and the divided lamp-cap, substantially as described.

38,999.—Moses B. Wright, West Meriden, Conn., for a Lamp Burner:

I claim, first, Having the wick wheel-shaft, D, made to vibrate substantially as and for the purpose herein shown and described.

Second, The combination of the wick tubes, B, and wicks, C C, with the plate, b, and the upper part of the jacket, A, substantially in the manner and for the purpose herein shown and described.

RE-ISSUES.

1,497.—Levi L. Hill, Hudson, N. Y. Patented June 17, 1862, for making Illuminated Gas:

I claim, first, Generating gas for illuminating and other purposes, by bringing water and a hydro-carbon fluid simultaneously in contact with freshly formed incandescent charcoal, substantially as set forth.

Second, Generating gas for illuminating and other purposes, by bringing water and a hydro-carbon fluid simultaneously in contact with freshly formed, incandescent coke, substantially as set forth.

Third, The use of freshly formed, incandescent charcoal or coke, for the decomposition of water or a hydro-carbon fluid, or of both combined, when applied simultaneously to the charcoal or coke, for the production of gas for illumination and other purposes, substantially as described.

Fourth, The combination of the gas from the distillation of wood, with that produced from the action of water and a hydro-carbon fluid, simultaneously applied to the freshly formed, incandescent charcoal from the wood, in the manner substantially as set forth, for the production of gas for illuminating and other purposes.

Fifth, The combination of the gas from the distillation of bituminous coal, or its equivalent, with that produced from the action of water and a hydro-carbon fluid, simultaneously applied to the freshly formed, incandescent coke from the coal, in the manner substantially as set forth, for the production of gas for illuminating and other purposes.

1,498.—John Kedzie, Rochester, N. Y., Patented July 11, 1854, for a Filter:

I claim a crock, B, provided with perforations, a a, and the eduction pipe, c, at its bottom; and communicating with the outer air at the top, by means of the pipe, f, or in an equivalent manner, said crock being used in combination with the surrounding packing, C, and receptacle, A, substantially as herein set forth.


## PATENT AGENCIES.

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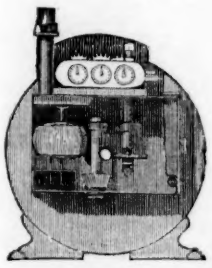

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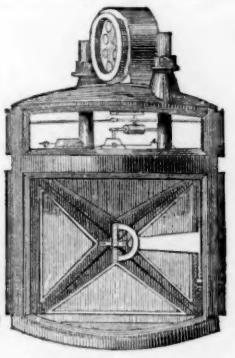

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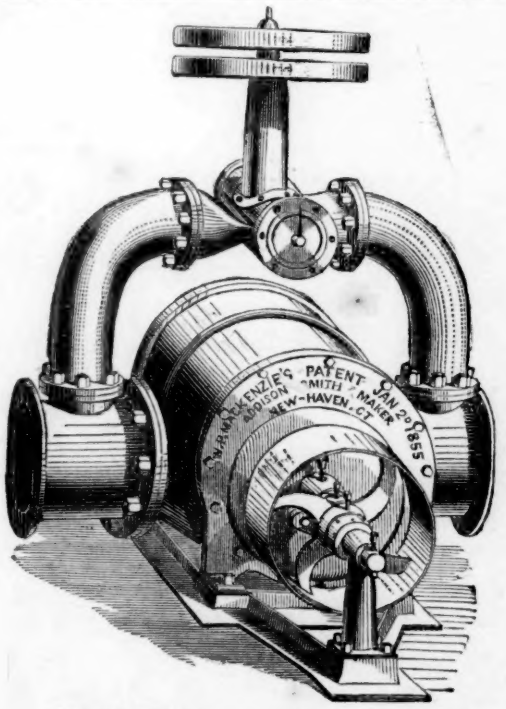


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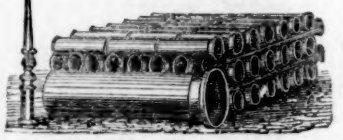

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